

105th Congress, 2d Session - - - - - House Document 105-174

CHARLESTON HARBOR, SOUTH CAROLINA  
DEEP DRAFT NAVIGATION PROJECT

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COMMUNICATION

FROM

THE ACTING ASSISTANT SECRETARY  
(CIVIL WORKS),  
THE DEPARTMENT OF THE ARMY

TRANSMITTING

A REPORT ON THE AUTHORIZATION OF A DEEP DRAFT NAVIGATION PROJECT FOR CHARLESTON HARBOR, SOUTH CAROLINA, PURSUANT TO PUB. L. 104-303, SEC. 101(a)(27)



JANUARY 27, 1998.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

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U.S. GOVERNMENT PRINTING OFFICE

46-055

WASHINGTON : 1998



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REPLY TO  
ATTENTION OF

DEPARTMENT OF THE ARMY  
OFFICE OF THE ASSISTANT SECRETARY  
CIVIL WORKS  
108 ARMY PENTAGON  
WASHINGTON DC 20310-0108  
09 DEC 1997

RECEIVED

DEC 12 AM 9:11

SPEAKER'S ROOMS  
U.S. HOUSE OF REPS.

Honorable Newt Gingrich  
Speaker of the House  
of Representatives  
Washington, D.C. 20515

Dear Mr. Speaker:

Section 101(a)(27) of the Water Resources Development Act of 1996, authorized a deep draft navigation project for Charleston Harbor, South Carolina. The Secretary of the Army supports the authorization and plans to implement the project through the normal budget process.

The authorized project is described in the report of the Chief of Engineers dated July 18, 1996, which includes other pertinent reports and comments. These reports are in final response to resolutions adopted by Senate Committee on Environment and Public Works and the House Committee on Public Works and Transportation on March 27, 1990, and August 1, 1990, respectively.

The views of the State of South Carolina, the Departments of the Interior and Transportation, and the Environmental Protection Agency are set forth in the enclosed report.

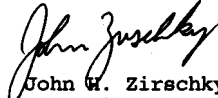
The authorized project maximizes net national economic development benefits consistent with environmental quality. The project consists of deepening the center 800 feet of the existing entrance channel to a depth of 47 feet below mean lower low water (MLLW) for a distance of about 16.3 miles, and increasing the depth of existing interior channels and turning basins to a depth of 45 feet below MLLW. The project would also include constructing a new turning basin near Daniel Island at a depth of 45 feet below MLLW, realigning the channel in the Shutes and Folly Reaches at a depth of 45 feet below MLLW, and widening and realigning the channel in the Daniel Island Reach at a depth of 45 feet below MLLW. The project also involves reducing the authorized dimensions of the Town Creek Channel from the Cooper River bridges to Myers Bend to a channel depth of 16 feet below MLLW and to a channel width of 250 feet, rebuilding two existing contraction dikes in

the Daniel Island Reach, removing a contraction dike located along Daniel Island, and constructing a new contraction dike in the Daniel Island Reach north of the Shipyard River. Construction of the project would require the initial excavation and disposal of about 33.3 million cubic yards of material. Material from both initial and maintenance dredging will be placed in an Environmental Protection Agency approved offshore disposal site, and in a confined upland disposal site. The project also includes the replacement of about one acre of tidal wetland habitat that would be lost through construction of the project.

Based on October 1995 price levels, the total first cost of the authorized project is about \$116,640,000. Of those costs, about \$71,940,000 would be Federal and about \$44,700,000 would be non-Federal.

The Office of Management and Budget advises that there is no objection to the submission of the report to the Congress. A copy of its letter is enclosed in the report.

Sincerely,



John W. Zirschky  
Acting Assistant Secretary of the Army  
(Civil Works)



## COMMENTS OF THE OFFICE OF MANAGEMENT AND BUDGET



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF MANAGEMENT AND BUDGET  
WASHINGTON, D.C. 20503

JUN 2 1996

The Honorable H. Martin Lancaster  
Assistant Secretary of the  
Army for Civil Works  
Pentagon - Room 2E570  
Washington, D.C. 20310-0108

Dear Mr. Lancaster:

We have completed our review of the following projects, as required by Executive Order 12322:

- Boston Harbor, Massachusetts, by letter of September 20, 1996;
- Blue River Basin, Dodson Industrial Area, Kansas City, Missouri, by letter of October 14, 1996;
- Charleston Harbor, South Carolina, by letter of July 19, 1996;
- Clifton, Arkansas, by letter of June 12, 1996;
- Columbia River Treaty Fishing Access Sites -- Phase II, by letter of July 23, 1996;
- Long Beach Island, New York, by letter of April 30, 1996;
- Lower Savannah River, South Carolina, by letter of September 17, 1996.

Our review concluded that your recommendations for these projects are consistent with the policies and program of the President. The Office of Management and Budget does not object to your submitting these reports to Congress.

We note that these projects have been at OMB for review beyond our normal review time. We regret any difficulties that this extended review time might have created. We are taking steps to improve the timeliness of these reviews to help the Corps and the local sponsors.

Sincerely,

T.J. Glauthier  
Associate Director  
Natural Resources,  
Energy and Science

## COMMENTS OF THE STATE OF SOUTH CAROLINA



State of South Carolina

Office of the Governor

DAVID M. BEASLEY  
GOVERNOR

POST OFFICE BOX 11369  
COLUMBIA 29211

May 3, 1996

Mr. David B. Sanford, Jr., Chief  
Policy Review & Analysis Division  
Directorate of Civil Works  
Department of the Army  
U.S. Army Corps of Engineers  
20 Massachusetts Avenue, N.W.  
Washington, D.C. 20314-1000

Dear Chief Sanford:

As governor of the State of South Carolina and on behalf of the citizens of our state, I am in full support of the Charleston Harbor Deepening/Widening project.

The report from the Chief of Engineers and the report of the district engineer on Charleston Harbor Deepening/Widening, South Carolina, has been reviewed in accordance with the process of Executive Order 12372, Intergovernmental Review of Federal Programs, and the State process instituted by South Carolina. It is an important project and vital to the economic well-being of the State. The State of South Carolina strongly supports expeditious authorization of the project.

Sincerely,

A handwritten signature in cursive script that reads "David M. Beasley".  
David M. Beasley

## COMMENTS OF THE DEPARTMENT OF THE INTERIOR



United States Department of the Interior

OFFICE OF THE SECRETARY  
Washington, D.C. 20240

ER 96/293

JUL 10 1996

Mr. David B. Sanford, Jr.  
Chief, Policy Review and Analysis Division  
Policy Review Branch  
ATTN: CECW-AR (SA)  
7701 Telegraph Road  
Alexandria, VA 22315-3861

Dear Mr. Sanford:

*The Department of the Interior has completed its review of the Chief of Engineers Proposed Report and Final Feasibility Report for the Charleston Harbor Deepening/Widening Project, Charleston County, South Carolina. The following comments are offered for your consideration.*

*Our U.S. Fish and Wildlife Service (FWS) has prepared a Fish and Wildlife Coordination Act (FWCA) report for the Charleston Harbor Deepening/Widening Project which appears appended within the document under review. Several FWCA report recommendations and the position of the FWS as stated in the FWCA remain valid and are restated below for purposes of clarity.*

- 1. Review through an interagency committee [i.e., Corps, FWS, South Carolina Department of Natural Resources (SCDNR), and National Marine Fisheries Service (NMFS)] the necessity and particulars of a dredging window for the "throat" of the harbor entrance between the jetties. This process should start by utilizing the methodology described in LaSalle (1991) and concentrate on important windows for ingress and egress of key resources such as penaeid shrimp, blue crab, flounder, and red drum.*
- 2. Establish a dredging window for hopper dredge work based on seasonally restricting work to periods when the water temperature is below 16 degrees Celsius. Coordinate with the National Marine Fisheries Service to implement this and any other necessary measures avoiding hopper dredging impacts to endangered sea turtles.*
- 3. Dispose of suitable materials at the Ocean Dredge Material Disposal Site (ODMDS) in accordance with the signed management plan agreement. Also, in accordance with this plan, coordinate with appropriate agencies to plan for detailed monitoring of disposal operations which track the fate of the materials and their ecological effects (especially for large volumes of fine sediments).*

4. Develop, in association with water quality agencies and resource agencies, a water quality management/monitoring plan. The plan should address potential harbor deepening water quality impacts, control measures, and monitoring both at the dredge sites and at disposal areas.

5. Avoid deepening any areas for which modeling indicates a high sedimentation rate.

6. Bulk sediment sampling should be conducted in accordance with the Ocean/Inland Testing Manuals for all areas with the exception of those which meet the exclusion criteria based on sediment grain size. The results of all sediment testing including the completed elutriate tests should be provided to the FWS for review.

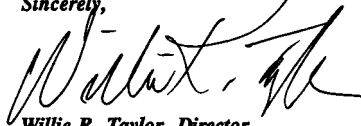
7. Conduct an alternatives' analysis for the new contraction dike in the Cooper River. The analysis should, within engineering efficiency constraints, evaluate location, alignment, and construction alternatives consistent with reduction in impact on intertidal habitats, especially those vegetated with emergent marsh.

The direct impact areas for the proposed project are largely limited to areas already disturbed for these purposes (i.e., dredging and deepening existing deep navigation channels; disposing of materials in existing disposal areas). As a result, the project should not result in significant and unacceptable impacts to fish and wildlife resources provided that the FWS's recommendations (above) are incorporated into the project. The FWS favors the shallower 42-foot depth project because of reduced dredge activity and volume both initially and for future maintenance activities. This alternative should be selected over the 45-foot depth alternative unless there is an overriding economic justification for choosing the latter.

Environmental documentation in compliance with the National Environmental Policy Act (NEPA) has not been initiated for the new port terminal facility. Therefore, the work proposed in accommodation of the proposed Daniel Island port terminal appears premature and pre-decisional relative to NEPA alternatives' analyses for port location.

If you have any questions, please contact Roger Banks or Steve Gilbert of the FWS's Charleston Field Office at 803/727-4707.

Sincerely,

A handwritten signature in black ink, appearing to read "Willie R. Taylor".

Willie R. Taylor, Director  
Office of Environmental Policy  
and Compliance



United States Department of the Interior

OFFICE OF THE SECRETARY  
Washington, D.C. 20240

ER 96/293

JUL 31 1996

Mr. David B. Sanford, Jr.  
Chief, Policy Review and Analysis Division  
Policy Review Branch  
ATTN: CECW-AR (SA)  
7701 Telegraph Road  
Alexandria, VA 22315-3861

RE: Additional Comments on  
Charleston Harbor Project

Dear Mr. Sanford:

This is a follow-up to the Department of the Interior's letter dated July 10, 1996, concerning the Chief of Engineers Proposed Report and Final Feasibility Report for the Charleston Harbor Deepening/Widening Project, Charleston County, South Carolina.

Following are additional comments prepared by our National Park Service (NPS), for your consideration and incorporation into our July 10, 1996 correspondence.

Increased widening and deepening of Charleston Harbor will allow more heavily laden traffic to use the small entrance into Charleston. Fort Sumter is just 2000-feet south of the current Mt. Pleasant Range of the channel. Although not managed by the NPS, a second fortification, Castle Pinckney, sits closer to Charleston on Shutes Folly Island.

Construction and regular maintenance dredging in the harbor often require the location of hydraulic dredging disposal piping to be close to the historic fort and on NPS lands. On occasion this work has resulted in damage to the fort's utilities causing shut down or interruptions to fort operations.

The long-term wave action associated with ships passing these historic forts has not been adequately addressed. Also, the movement of existing or abandoned dredge disposal areas has not been adequately evaluated concerning potential impacts on historic structures. For example, the channel between Spider Island, an abandoned disposal site, and Fort Sumter has been closing over the past few years. Fort Sumter will be linked to Fort Johnson by a land bridge if this trend continues. This is affecting the resources of Fort Sumter and the historic scene.

The NPS wants to work with the Corps to address these concerns as they develop the project. For further information, please contact John N. Tucker, Superintendent, Ft. Sumter National Monument at 803/883-3123.

Sincerely,

Willie R. Taylor, Director  
Office of Environmental Policy  
and Compliance

## COMMENTS OF THE DEPARTMENT OF TRANSPORTATION

U.S. Department  
of Transportation  
o-nro  
United States  
Coast Guard



Commandant  
U.S. Coast Guard

2100 Second St. S.W.  
Washington, DC 20593-0001  
Staff Symbol:  
Phone: (202) 267-051A

16450

JUN 3 1996

Mr. David B. Sanford, Jr.  
Chief, Policy Review and Analysis Division  
Directorate of Civil Works  
Department of the Army  
7701 Telegraph Road  
Alexandria, Virginia 22315-3861

Dear Mr. Sanford:

This is in response to your letter of April 20, 1996, in which you forwarded the proposed report of the Chief of Engineers and the report of the district engineer on Charleston Harbor Deepening/Widening, South Carolina. We have reviewed the proposed report and have no comments regarding the environmental impacts.

We understand the recommendations of the report may change based on budgetary and policy considerations prior to transmittal to Congress as a proposal for authorization and implementation funding. Should this occur the U.S. Coast Guard will be advised of any modification and afforded an opportunity to comment further.

Thank you for providing the Coast Guard the opportunity to review the proposed report.

Sincerely,

R. E. Bennis  
Captain, U.S. Coast Guard  
Chief, Office of Response  
By direction of the Commandant

## COMMENTS OF THE ENVIRONMENTAL PROTECTION AGENCY



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

345 COURTLAND STREET, N.E.  
ATLANTA, GEORGIA 30365

JUN 4 1996

Department of the Army  
Policy Review Branch  
ATTN: CEWRC-AR (SA)  
7701 Telegraph Road  
Alexandria, VA 22315-3861

Subject: Environmental Assessment (EA) for the Charleston Harbor  
Deepening/Widening, South Carolina

Dear Sir:

Pursuant to Section 309 of the Clean Air Act, EPA, Region 4 has reviewed the subject document which evaluates various upgrade measures to facilitate navigation at Charleston Harbor. In our original comments on this proposal we raised a number of issues which we felt should be addressed prior to finalizing the "Finding of No Significant Impact." Immediately after we indicated that these matters were not addressed by the Charleston District (Re: EPA Letter, June 3, 1996) our office received a complete, detailed response to each of these initial concerns. This additional exposition satisfactorily addresses our interests in this proposed action.

If we can be of further assistance, Dr. Gerald Miller (404-347-3555 VM 6853) will serve as initial point of contact.

Sincerely yours,

A handwritten signature in cursive script that reads "Heinz J. Mueller".

Heinz J. Mueller, Chief  
Environmental Policy Section  
Federal Activities Branch



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

345 COURTLAND STREET, N.E.  
ATLANTA, GEORGIA 30365

MAY 3 1995

Department of the Army  
Policy Review Branch  
ATTN: CEWRC-AR (SA)  
7701 Telegraph Road  
Alexandria, VA 22315-3861

Subject: Environmental Assessment (EA) for the Charleston Harbor  
Deepening/Widening, South Carolina

Dear Sir:

Pursuant to Section 309 of the Clean Air Act, EPA, Region 4 has reviewed the subject document which evaluates various upgrade measures to facilitate navigation at Charleston Harbor. In our original comments on this proposal we raised a number of issues (see attached) which we felt should be addressed prior to finalizing the "Finding of No Significant Impact." These matters were not addressed by the Charleston District and, in our opinion, remain operative.

If we can be of further assistance, Dr. Gerald Miller (404-347-3555 VM 6853) will serve as initial point of contact.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Heinz J. Mueller".

Heinz J. Mueller, Chief  
Environmental Policy Section  
Federal Activities Branch



## COMMENTS OF THE DEPARTMENT OF COMMERCE

---



UNITED STATES DEPARTMENT OF COMMERCE  
Office of the Under Secretary for  
Oceans and Atmosphere  
Washington, D.C. 20230

June 13, 1996

Department of the Army  
Charleston District  
Corps of Engineers  
P.O. Box 919  
Charleston, SC 29402-0919

Dear Whom it May Concern:

Enclosed are comments on the U.S. Army Corps of Engineers, Charleston Harbor, Charleston, South Carolina, Final Feasibility Report with Environmental Assessment, February 1996. We hope our comments will assist you. Thank you for giving us an opportunity to review this document.

Sincerely,

A handwritten signature in cursive script, reading "Donna S. Wieting".

Donna S. Wieting  
Acting Director  
Ecology and Conservation Office

Enclosure

cc:  
South Carolina State Ports Authority  
P.O. Box 817  
Charleston, SC 29402-0817

NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION (NOAA)

COMMENTS ON

U.S. ARMY CORPS OF ENGINEERS, CHARLESTON HARBOR

CHARLESTON, SOUTH CAROLINA, FINAL FEASIBILITY

REPORT WITH ENVIRONMENTAL ASSESSMENT,

FEBRUARY 1996

This is a NOAA National Ocean Service response to the report, **U.S. Army Corps of Engineers, Charleston Harbor, Charleston, South Carolina, Final Feasibility Report with Environmental Assessment, February 1996.**

The project plan includes considerable dredging, channel realignment, new turning basins, and contraction dike construction. NOAA's National Ocean Service (NOS) has a strong concern that these activities will alter hydrodynamic conditions and tidal characteristics, resulting in the degradation of NOAA's existing tide and tidal current prediction products and tidal datums. Currents, in particular, can vary dramatically over short distances with bathymetric changes. The Code of Federal Regulations requires all self-propelled vessels of 1600 or more gross tons operating in the navigable water of the United States to carry NOAA Tide and Tidal Current Prediction Tables in support of safe navigation. As USACE continues to deepen and widen channels to accommodate larger ships and deeper drafts, we must find a way to ensure that navigation products are updated when they are rendered inaccurate as a result of USACE dredging projects. The existing NOAA budget does not provide funds to acquire the new current and water level measurements required to update prediction products after these products have been degraded by USACE activities.

A growing unacceptability of maritime navigation risk can be seen in today's cleanup and litigation costs. As the average size of today's commercial ships continues to grow, the margins between their bottoms and the floors of the channels they sail through are shrinking. Maneuverability is increasingly restricted, raising the risk of oil and other hazardous material spills. The uncertainty resulting from unreliable tide and current predictions means that large commercial carriers and tankers will be delayed at ports and offshore waiting for optimal transit conditions. Efficiency and safety dictate the bottom line of today's intensely competitive shipping industry.

In the past, NOS has received complaints about changes in currents and the resulting inadequacy of NOS tidal current predictions after the deepening and altering of navigation channels, such as by Chesapeake Bay maritime interests. Since we expect similar changes in Charleston Harbor after the dredging, channel realignment, and construction project, NOS will have to officially notify mariners that "tidal current predictions for this region should be considered questionable at best and potentially dangerous to rely on. Tide predictions will also be affected but to a lesser degree." Notification would appear in the Notice to Mariners, the Coast Pilot, in a note on currents in the next publication of the relevant nautical chart(s), and as a note in the NOAA Tidal Current Tables.

We recommend that funding be provided to NOAA/NOS to conduct a re-survey of the Charleston Harbor water levels and currents to ensure the continuing accuracy of NOAA tide and tidal current predictions and tidal datums. Working agreements exist between NOAA and USACE for the provision of tidal datums from NOAA to USACE for use by USACE contractors before beginning dredging operations, via reimbursable tasks. However, no agreements exist to provide for the assessment and revision of tide and tidal current predictions and tidal datums following a USACE project. The agreement should be modified to allow USACE to provide routine reimbursement of the funds to NOS that are necessary to compensate for the effects of USACE dredging operations on NOAA/NOS products.

Another alternative would be for the USACE project to fund a Charleston Harbor federal/local partnership that would design, install, and maintain a Physical Oceanographic Real-Time System (PORTS) patterned after other NOAA PORTS installations, especially the highly successful one in Tampa Bay. Maximum economic and safety benefits from the deepened channels could be realized from the real-time acquisition and dissemination of currents, water levels, winds, and other oceanographic and meteorological data from multiple locations. The PORTS centralized data acquisition and dissemination system would provide the data and information to the Charleston Harbor maritime community in a variety of user-friendly forms.

Even though the subject report references hydrodynamic and salinity intrusion modeling activities, insufficient details regarding the results from the model runs are provided. We recommend that the modeling results be extensively described, including model description, probable errors, and accuracy of model predictions. Changes in water level ranges and currents throughout the estuary should be defined and described.

Throughout the report, considerable emphasis is put on reducing transportation costs from tidal delays and light-loading. The mariner requires the very best navigation data that can be made available to minimize tidal delay costs and to maximize loading capacity as a function of ship draft, channel depth, and water level stage. The report discusses how strong tidal currents in the Cooper River forces ships traveling with the currents to transit at a fairly high speed to maintain steerage. More accurate information regarding current velocities will provide ship pilots with a wider margin of safety for these transits.

The report provides budget figures for Aids to Navigation. As stated earlier, the funds required to update the tide and tidal current prediction products should also be included as part of the project budget.

Specific comments are as follows:

In Environmental Assessment, Appendix A, (b) Velocity, is the statement, "...As the channel is straightened, velocities may increase in the channel where the realignment is made; however, these changes are not expected to have a significant environmental effect..." What does this statement mean? If the velocities increase and the navigation products for that area are made inaccurate, does not that indicate that the probability of a marine accident involving oil or another hazardous material increases?

In Environmental Assessment, Appendix C, page 6, is a list of direct impacts of channel dredging which includes ... (3) Hydraulic modifications which in turn potentially affect circulation patterns, tidal exchange, sedimentation patterns, and salinity distribution. Once again, the report does not provide a level of detail to allow analysis resulting from hydraulic modification.

In Environmental Assessment, Appendix C, page 9, top paragraph, last sentence, it is stated, "...According to a model run by the Corps' Waterways Experiment Station, the project would not result in a change in salinity patterns in the harbor..." Are those people who are responsible for the environmental health of Charleston Harbor comfortable with that statement without knowing more about the model and evaluating the model results?

Appendix A, page 3, states, "...Since about 70 percent of the Cooper River freshwater inflow was diverted in 1985 and the Federal channels have just recently been deepened to 40 feet MLW, the system is presently undergoing substantial change to these new conditions." If the system is indeed still undergoing dynamic adjustments, then how can hydrodynamic, salinity intrusion, and sedimentation model runs provide reliable results with acceptable uncertainty?

Appendix E, page 55, shows a table illustrating benefit computations. Consideration should be given to a multiple location (loading docks, gantry facilities, etc.) PORTS like system that would provide load masters and transit planners with real-time water levels and currents that would allow the capability to maximize cargo loading while maintaining an adequate margin of safety.

Appendix F, letter from EPA to USACE, dated December 13, 1995, with draft environmental assessment comments, states "...This proposal has an extensive scope, a large economic component, significant environmental/societal/economic ramifications, and takes place over a fifty-year period. Decision-making associated with projects of this magnitude/type are normally addressed in the context of an environmental impact statement. Hence, the District's election to use the EA format is perplexing given the absence of specific discussion as to how/why the determination to use this model was reached. Subsequent documentation should provide detailed exposition regarding the rationale(s) for the conclusion that a FONSI (Finding of No Significant Impact) is, in fact, appropriate..." Again, the details required to evaluate the science, techniques, model applications and documentation, and analysis results are inadequate.

# CHARLESTON HARBOR DEEPENING/WIDENING, SOUTH CAROLINA

## REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314-1000

REPLY TO  
ATTENTION OF:

CECW-PE (10-1-7a)

18 JUL 1996

SUBJECT: Charleston Harbor Deepening/Widening, South Carolina -  
10331

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report, Charleston Harbor Deepening/Widening, South Carolina - 10331. It is accompanied by the report of the district and division engineers. These reports are in final response to resolutions by the Committee on Environment and Public Works of the United States Senate and by the Committee on Public Works and Transportation of the U. S. House of Representatives adopted March 27, 1990 and August 1, 1990, respectively. These resolutions requested a review of previous reports on Charleston Harbor, South Carolina, to determine if modifying the existing Federal project is advisable, particularly regarding deepening and/or widening. Preconstruction engineering and design activities for the recommended improvements will continue under authority of these resolutions.

2. The reporting officers recommend constructing a 16.3-mile-long, 47-foot-deep by 800-foot-wide entrance channel; increasing the depth of interior channels and turning basins to 45 feet; constructing a new turning basin near Daniel Island; realigning the channel in the Shutes/Folly Reach; widening/realigning the channel in the Daniel Island Reach; reducing authorized dimensions for the Town Creek Channel from the Cooper River bridges to Myers Bend to 16-foot-deep by 250-foot-wide; rebuilding two existing contraction dikes in the Daniel Island Reach; removing a third contraction dike located along Daniel Island, and constructing a new contraction dike in Daniel Island Reach north of Shipyard River. The recommended plan is the national economic development plan.

3. Project costs are allocated to the navigation project purpose. At October 1995 prices, the estimated total first cost of the recommended plan is \$116,639,000, of which \$72,798,000 would be Federal and \$43,841,000 would be non-Federal. The equivalent average annual benefits and costs, at 7.625 percent

discount rate and 50-year period of economic analysis, are \$19,511,000 and \$11,511,000, respectively. Net benefits are estimated as \$8,000,000 annually. The benefit-cost ratio is 1.7.

4. Washington level review indicates that the proposed plan is technically sound, economically justified, and environmentally acceptable. The proposed project complies with applicable U.S. Army Corps of Engineers planning procedures and regulations. Also, the views of interested parties, including Federal, State, and local agencies have been considered.

5. Accordingly, I recommend implementation of the proposed project generally in accordance with the reporting officers recommended plan, with such modifications as in the discretion of the Chief of Engineers may be advisable, and subject to applicable cost-sharing and financing requirements. My recommendation is made with the provision that, prior to implementation of the recommended improvements, the non-Federal sponsor shall enter into a binding agreement with the Federal Government to comply with the following requirements:

a. Provide and maintain, at their own expense, the local service facilities.

b. Provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, and maintenance of the general navigation features and the local service facilities.

c. Provide all improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the general navigation features and the local service facilities. Such improvements may include, but are not necessarily limited to, retaining dikes, wasteweirs, bulkheads, embankments, monitoring features, stilling basins, and dewatering pumps and pipes.

d. Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation features:

- 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet; plus

- 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet.

e. Repay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, an additional 0 to 10 percent of the total cost of construction of general navigation features depending upon the amount of credit given for the value of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas provided by the non-Federal sponsor for the general navigation features. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the non-Federal sponsors shall not be required to make any contribution under this paragraph, nor shall they be entitled to any refund for the value of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas, in excess of 10 percent of the total cost of construction of the general navigation features.

f. For so long as the project remains authorized, operate and maintain the local service facilities and any dredged or excavated material disposal areas that are not restoration plan features in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government.

g. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsors, now or hereafter, own or control for access to the general navigation features for the purpose of inspection and, if necessary, for the purpose of operating and maintaining the general navigation features.

h. Hold and save the United States free from all damages arising from the construction, operation, and maintenance of the general navigation features, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors.

i. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after completion of the



accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20.

j. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, and maintenance of the general navigation features. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigation in accordance with such written direction.

k. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsors, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, or maintenance of the general navigation features.

l. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA.

m. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, and maintenance, of the general navigation features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

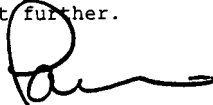
n. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

o. Provide a cash contribution equal to the following percentages of total historic preservation mitigation and data recovery costs attributable to commercial navigation that are in excess of one percent of the total amount authorized to be appropriated for commercial navigation:

- 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet; plus

- 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet.

6. The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the executive branch. Consequently, the recommendations may be modified before they are transmitted to Congress as a proposal for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the South Carolina State Ports Authority; the State of South Carolina; interested Federal agencies; and other parties will be advised of any modifications and will be afforded an opportunity to comment further.



PAT M. STEVENS IV  
Major General, USA  
Acting Chief of Engineers

## **Addendum**

Paragraph 3(a) of the Project Guidance Memorandum for this study calls for CECW-AR coordination with CECW-PD and IWR regarding the vessel operating costs that were used to compute project benefits. This coordination was accomplished in January and February of 1996 and in response to the discussions that took place, CECW-P directed the District to recompute project benefits using the vessel operating costs presented in the FY95 Economics Guidance Memorandum [EGM].

The District recomputed project benefits using the methods described in Appendix E (Economics); all inputs except vessel operating costs were held constant at their original values. The results of this analysis are presented in this addendum to the Main Report and reconfirm that the recommended plan is the NED plan. The District has coordinated with CECW-P regarding the preparation of this addendum.

The use of the vessel operating costs from the FY95 EGM resulted in declines of various magnitudes in transportation costs and project benefits. Container traffic was less affected by this change than were dry and liquid bulk cargo. Baseline transportation costs associated with container traffic declined by about 4 percent with the use of the vessel operating costs from the FY95 EGM and benefits declined by about 6 percent. The impact on dry and liquid bulk traffic was more pronounced, with baseline transportation costs declining by about 10 percent and benefits declining 15 to 20 percent.

The three major components of the recommended plan are the channel deepening project, a turning basin for the Daniel Island Terminal, and a channel realignment project in the Shutes and Folly reaches of the harbor. Table 1 summarizes the benefits associated with the total deepening project and Table 2 shows the benefit-cost comparisons for the various channel depths. Net benefits are maximized with the 45-foot project depth, with a benefit-cost ratio of 1.75.

The revised benefits and benefit-cost ratios for the Daniel Island Turning Basin and the Shutes/Folly Realignment are shown in Tables 3 and 4, respectively. Net benefits for the turning basin are maximized at a depth (of the turning basin) of 45-feet, with a benefit-cost ratio of 1.15. The Shutes/Folly Realignment is also shown to be feasible, with a benefit-cost ratio of 1.67.

As noted above, the use of the vessel operating costs shown in the FY95 EGM did not result in any changes to the original recommendations. Revised average annual net benefits of the total recommended project are \$7.5 million, with a benefit-cost ratio of 1.70. A summary of the re-evaluated costs and benefits of the total recommended project is shown in Table 5.

Table 1  
 Charleston Harbor Study  
 Re-Evaluation of Channel Deepening Benefits  
 Using FY95 EGM Vessel Operating Costs

Item	Channel Depth					
	41	42	43	44	45	46
<u>Present Value of Benefits</u>						
European Containers	19,800.3	33,787.6	57,021.1	76,872.7	88,380.8	93,211.8
Pacific Containers	39,638.9	45,468.8	50,998.6	59,524.4	59,524.4	59,524.4
Coal	17,886.5	20,111.5	22,903.0	24,176.0	25,295.4	25,295.4
Grains	1,864.6	3,056.4	3,794.2	4,905.3	6,320.2	7,735.0
Iron	480.0	556.1	619.1	629.0	668.4	707.4
Petro	13,680.3	20,139.9	24,470.4	24,908.2	27,365.0	29,821.8
Subtotal	93,350.7	123,120.3	159,806.4	191,015.7	207,554.2	216,295.9
BDC	511.2	1,970.3	2,717.5	4,165.6	5,019.0	7,026.5
Total	93,861.9	125,090.6	162,523.9	195,181.3	212,573.2	223,322.4
<u>Average Annual Benefits</u>						
European Containers	1,549.1	2,643.4	4,461.0	6,014.1	6,914.5	7,292.4
Pacific Containers	3,101.1	3,557.3	3,989.9	4,656.9	4,656.9	4,656.9
Coal	1,399.4	1,573.4	1,791.8	1,891.4	1,979.0	1,979.0
Grains	145.9	239.1	296.8	383.8	494.5	605.1
Iron	37.6	43.5	48.4	49.2	52.3	55.3
Petro	1,070.3	1,575.6	1,914.4	1,948.7	2,140.9	2,333.1
Subtotal	7,303.3	9,632.3	12,502.4	14,944.1	16,238.0	16,921.9
BDC	40.0	154.1	212.6	325.9	392.7	549.7
Total	7,343.3	9,786.4	12,715.0	15,270.0	16,630.6	17,471.6

Source: Computations by the Charleston District.

Table 2  
 Charleston Harbor Study  
 Re-Evaluation of Net Benefits for  
 Complete Harbor Deepening Project  
 Using FY95 EGM Vessel Operating Costs  
 (Thousands of 1995 Dollars)

Item	Project Draft in Feet					
	41	42	43	44	45	46
<u>General Navigation Features</u>						
Channel Deepening	34,093	44,918	51,798	59,596	65,407	73,916
Contraction Dikes	3,569	3,569	3,569	3,569	3,569	3,569
Mitigation	20	20	20	20	20	20
Subtotal	37,682	48,507	55,387	63,185	68,997	77,505
Contingencies, 15 Percent	5,652	7,276	8,308	9,478	10,349	11,626
Subtotal	43,335	55,783	63,695	72,663	79,346	89,130
Monitoring of ODMDS	500	500	500	500	500	500
PEB	2,620	2,620	2,620	2,620	2,620	2,620
Construction Management	1,600	1,600	2,000	2,000	2,000	2,400
Total	48,055	60,503	68,815	77,783	84,466	94,650
<u>Aids to Navigation</u>	78	78	78	78	78	78
<u>Non-Federal Costs</u>						
Berthing Areas	4,290	4,505	4,679	4,698	5,229	5,405
Disposal Diking	583	939	1,322	1,720	2,130	2,549
Real Estate	15	15	15	15	15	15
Subtotal	4,888	5,459	6,016	6,433	7,373	7,968
Contingencies, 15 Percent	733	819	902	965	1,106	1,195
Total	5,621	6,278	6,919	7,397	8,479	9,164
Total First Costs	53,754	66,859	75,812	85,258	93,023	103,892
IDC	9,844	12,601	13,578	15,402	16,704	18,060
Total Investment Cost	63,598	79,459	89,390	100,661	109,727	121,952
<u>Average Annual Cost</u>						
Interest	4,849	6,059	6,816	7,675	8,367	9,299
Amortization	126	158	177	200	218	242
Annual O&M	145	341	538	734	930	1,227
Total AAC	5,121	6,557	7,531	8,609	9,515	10,768
<u>Average Annual Benefits</u>						
Channel Deepening	7,343	9,786	12,715	15,270	16,631	17,472
<u>B/C Ratio</u>						
	1.43	1.49	1.69	1.77	1.75	1.62
<u>Net Benefits</u>	2,222	3,229	5,184	6,661	7,116	6,704

Source: Computations by the Charleston District; reflects January 1995 dollars and the current federal discount rate of 7.625 percent.

Table 3  
 Charleston Harbor Study  
 Re-Evaluation of Net Benefits of  
 Daniel Island Turning Basin  
 Using FY95 EGM Vessel Operating Costs  
 (Thousands of 1995 Dollars)

Item	Project Draft in Feet				
	41	42	43	44	45
<u>Summary of Costs</u>					
<u>General Navigation Features</u>					
Construction Cost	\$6,388	\$6,656	\$6,950	\$7,244	\$7,482
Contingencies	<u>958</u>	<u>998</u>	<u>1,043</u>	<u>1,087</u>	<u>1,122</u>
Total First Costs	7,347	7,655	7,993	8,330	8,604
IDC*	<u>(362)</u>	<u>(377)</u>	<u>(393)</u>	<u>(410)</u>	<u>(423)</u>
Total Investment Cost	6,985	7,287	7,599	7,920	8,181
<u>Average Annual Costs</u>					
Interest	532	555	579	604	624
Amortization	14	14	15	16	16
Annual O&M	<u>55</u>	<u>59</u>	<u>62</u>	<u>66</u>	<u>70</u>
Total AAC	601	628	657	686	710
<u>Average Annual Benefits</u>					
Total AAB	674	677	742	775	813
B/C Ratio	1.12	1.08	1.13	1.13	1.15
Net Benefits	73	49	85	89	103

Source: Computations by Charleston District; reflects January 1995 dollars and the current federal discount rate of 7.625 percent.

\* Reflects discounting of costs incurred after base year of 2002.

Table 4  
 Charleston Harbor Study  
 Re-Evaluation of Net Benefits of  
 Shutes/Folly Channel Realignment  
 Using FY95 EGM Vessel Operating Costs  
 (Thousands of 1995 Dollars)

Item	Costs/Benefits for 45' Channel
<u>Summary of Costs</u>	
<u>Existing Alignment</u>	
Construction Cost	
Rebellion/Folly Reach	\$4,094
Horse/Shutes Reach	1,732
Contingencies	<u>873</u>
Subtotal	6,700
<u>New Alignment</u>	
Construction Cost	
Rebellion/Folly Reach	3,670
Horse/Shutes Reach	6,246
Contingencies	<u>1,487</u>
Subtotal	11,402
Total Incremental First Cost	4,702
IDC	<u>1,263</u>
Total Investment Cost	5,965
<u>Average Annual Cost</u>	
Interest	455
Amortization	12
O&M	<u>10</u>
Total AAC	477
<u>Average Annual Benefits</u>	
Delay Reduction	378
Reduced Transit Time	<u>417</u>
Total AAB	795
<u>B/C Ratio</u>	1.67
<u>Net Benefits</u>	318

Source: Computations by Charleston District; reflects  
 January 1995 dollars and the current federal  
 discount rate of 7.625 percent.

Table 5  
 Charleston Harbor Study  
 Re-Evaluation of Net Benefits of  
 Total Harbor Project  
 Using FY95 EGM Vessel Operating Costs  
 (Thousands of 1995 Dollars)

Item	Main Channel	Daniel Island Turning Basin	Shutes/Folly Realignment	Total Project
Total First Costs	\$93,023	\$8,604	\$4,702	\$106,330
IDC	<u>16,704</u>	<u>(423)</u>	<u>1,263</u>	<u>17,544</u>
Total Investment Cost	109,727	8,181	5,965	123,873
<u>Average Annual Costs</u>				
Interest	8,367	624	455	9,445
Amortization	218	16	12	246
Annual O&M	<u>910</u>	<u>70</u>	<u>10</u>	<u>1,010</u>
Total AAC	9,515	710	477	10,701
<u>Average Annual Benefits</u>				
Total AAB	16,631	813	795	18,239
<u>B/C Ratio</u>	1.75	1.15	1.67	1.70
<u>Net Benefits</u>	7,116	103	318	7,538

Source: Computations by Charleston District; reflects January 1995 dollars and the current federal discount rate of 7.625 percent.



## EXECUTIVE SUMMARY

This report has been prepared under authority of resolutions adopted by the Senate Committee on Environment and Public Works and the House Committee on Public Works and Transportation on 27 March 1990 and 1 August 1990, respectively. These resolutions authorized the Corps of Engineers to conduct a review of the reports on Charleston Harbor, South Carolina with a view of determining whether any modifications to the existing project are advisable at this time with particular emphasis on deepening and widening. Planning, Engineering and Design (PED) studies will be continued under this authority.

Charleston Harbor is the largest and most important seaport in South Carolina and is ranked as the second largest container port on the East Coast and Gulf Coast of the United States. The harbor is a natural tidal estuary formed by the confluence of the Cooper, Ashley and Wando Rivers and located about midway of the South Carolina coastline, being approximately 140 statute miles southwest of the entrance to Cape Fear River, North Carolina, and 75 statute miles northeast of the Savannah River, Georgia.

The authorized Charleston Harbor Project was essentially completed in August 1991 with the exception of the Wando River Extension (August 1994) and Shipyard River Entrance (June 1996). The authorized project provides for a 42 foot deep by 1,000 foot wide entrance channel extending for approximately 11 miles from the 42 foot contour to the mouth of the harbor; thence, 40 foot deep by 600 foot wide (generally) to Goose Creek on the Cooper River a distance of 16 miles; a 2.1 mile long 40 foot deep channel in the Wando River extending from the Cooper River to the Wando Terminal; 0.7 miles of improvements in Shipyard River consisting of a 38 foot deep by 300-foot wide entrance channel, and a 700 foot diameter Turning Basin A, a 30 foot deep by 200 foot upper channel and a 500 foot diameter Turning Basin B; 2.8 miles of improvements in Town Creek 40 foot deep by various widths; an anchorage basin at the junction of Ashley and Cooper Rivers 35 foot deep approximately 2,200 feet by 5,200 feet; three turning basins 1,400 feet in diameter in Town Creek, Wando River and at the head of the project. Features that are authorized but not constructed include: a 1,000 foot Turning Basin A in Shipyard River and deepening and widening the upper channel to 38 feet deep by 250 feet wide; widening Turning Basin B to 1,000 feet, this feature was determined not to be economically justified; and deepening and enlarging the anchorage basin to 40 feet.

Existing channel depths, widths, and alignments constrain the ability of vessels to utilize the port to their design capacity, increase transit time due to limited ability to pass except at designated locations, and/or present hazardous conditions. Vessels with deeper draft will be able to take advantage of a deeper channel and reduce transportation costs from tidal delays. Additional transportation savings will result from improved passing areas and alignments. Benefits from improved depths of 41 to 46 feet were considered in this study.

The 45-foot channel depth was identified as the National Economic Development (NED) plan and is the recommended plan. The recommended plan provides a 16.3 mile 47 foot by 800 foot wide entrance channel, 45 foot interior channels, and turning basins, with no improvement in width unless otherwise noted, and a realigned channel in the Shutes/Folly Reach of the lower harbor, and reduction of the Town Creek Channel from the Cooper River bridges to Myers Bend to a 16 foot by 250 foot channel. The Daniel Island Reach channel will be widened to 875 feet beginning at the conjunction of Myers Bend tapering to a width of 600 feet at Daniel Island Bend. Features for construction to coincide with the completion of the proposed Daniel Island Terminal are: construction of an additional contraction dike located just north of Shipyard River and the Navy degaussing pier, restoration of the existing training dikes to their original condition when the third is constructed, removal of existing contraction dike on Daniel Island, and construction of a turning basin 1,400 feet by 1,400 ft.

Based on the construction schedule, the total initial project cost is estimated to be \$116,639,000. Of this amount \$27,020,000 would be the initial sponsor cost share of the general navigation features for 25 percent of the first cost. The sponsor is responsible for 100 percent of the dredging cost associated with deepening all berthing areas to the project depth in the amount of \$6,012,000. The initial Federal share of the general navigation features of first cost is \$81,062,000. The sponsor shall pay an additional 10 percent of the cost of the general navigation features of the project in cash over a period not to exceed 30 years, at an interest rate determined pursuant to section 106 of WRDA 86. The value of lands, easements, rights-of-way, relocations, and dredged material disposal areas shall be credited toward the additional 10 percent. This credited amount is estimated to be \$2,466,000 bringing the total initial sponsor share of first cost to \$43,841,000 with total Federal share being \$72,798,000.

The South Carolina State Ports Authority (SPA) is the project sponsor. They support the plan recommended in this report.

## ADDENDUM

Revised Economic Summary  
Charleston Harbor Deepening/Widening, South Carolina  
(\$1000s, October 1995 Price Level, 7.625 Percent Discount Rate, 50-Year Period of Economic Analysis)

	Main Channel <sup>1/</sup>	Daniel Island Turning Basin	Shutes/Folly Realignment	Total Project
Total First Costs	\$ 103,333	\$ 8,604	\$ 4,702	\$ 116,639
IDC <sup>2/</sup>	<u>16,745<sup>2/</sup></u>	<u>(423)<sup>2/</sup></u>	<u>1,263</u>	<u>17,585</u>
Total Investment Cost	\$ 120,078	\$ 8,181	\$ 5,965	\$ 134,224
Average Annual Costs				
Interest	\$ 9,156	\$ 624	\$ 455	\$ 10,235
Amortization	239	16	12	266
Annual O&M	<u>930</u>	<u>70</u>	<u>10</u>	<u>1,010</u>
Total AAC	\$ 10,325	\$ 710	\$ 477	\$ 11,511
Average Annual Benefits	\$ 17,856	\$ 832	\$ 823	\$ 19,511
Average Annual Costs	<u>10,325</u>	<u>710</u>	<u>477</u>	<u>11,511</u>
Net Benefits	\$ 7,531	\$ 122	\$ 346	\$ 8,000
B/C Ratio	1.7	1.2	1.7	1.7

<sup>1/</sup> Includes cost of the Daniel Island Reach Widening/Realignment.

<sup>2/</sup> Interest-During-Construction reflects adjustment for about \$25.1 million in post-base year expenditures.

## CHARLESTON HARBOR, SOUTH CAROLINA DRAFT FEASIBILITY REPORT

### **1. The Study and the Report**

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#### **1.1 Study Authority**

The study for the Charleston Harbor Deepening/Widening was authorized by resolutions adopted on 27 March 1990 and 1 August 1990, respectively, by the Senate Committee on Environment and Public Works and the House Committee on Public Works and Transportation.

"Resolved by the Committee on Environment and Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports of the Chief of Engineers on Charleston Harbor, South Carolina dated August 27, 1981 and May 1, 1985 (the latter published as House Document Number 100-27, 100th Congress, 1st Session) and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at this time in the interest of navigation, with particular view toward deepening and/or widening."

"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, that the Board of Engineers for Rivers and Harbors is requested to review the reports on Charleston Harbor, South Carolina, published as House Document 100-27, One Hundredth Congress, First Session, and other pertinent reports, to determine whether any modifications of the recommendations contained therein are advisable at this time in the interest of navigation, with particular emphasis on deepening and widening."

The feasibility phase of this project was initiated in April 1993 when the reconnaissance report was approved and the Feasibility Cost Sharing Agreement (FCSA) was signed.

#### **1.2 Study Purpose and Scope**

The purpose of this study was to evaluate problems and opportunities for improved navigation in Charleston Harbor and to recommend the plan that best satisfies the

environmental, economic, and engineering criteria. The scope of this feasibility study involves analysis of existing conditions and requirements, identifying opportunities for enhancement, determining alternative plans for improvement, preparing economic analyses of alternatives, identification of environmental impacts, and identification of the National Economic Development (NED) plan.

### **1.3 Non-Federal Partner**

The South Carolina State Ports Authority (SCSPA) was created to develop and improve the harbors and seaports of South Carolina for the handling of waterborne commerce from and to any part of the state and other states or foreign countries. They are the non-Federal partner for the Charleston Harbor project and have full authority and capability to provide all non-Federal requirements.

### **1.4 Evaluation Criteria**

**1.4.1 Regulations and Guidance.** Authority for the Corps of Engineers to investigate the need for navigation improvements and to construct those improvements is derived from Federal legislation and Executive Orders. These laws and orders are implemented by regulations that establish the engineering, economic, and environmental criteria used to determine whether the Federal Government can participate in a potential project. The principal regulations that determine the scope of the present study are as follows: *Economic Principles and Guidelines for Water Resources and Related Land Resources Implementation Guidelines* (Water Resources Council, March 10, 1983); Engineering Regulation (ER) 1105-2-100, *Guidance for Conducting Civil Works Planning Studies*; ER 200-2-2, *Policy and Procedures for Implementing NEPA* (NEPA is the National Environmental Policy Act of 1969), and ER 1110-2-1150, *Engineering and Design for Civil Works Projects*, 31 March 1994. The following paragraphs describe conditions placed by regulation for the feasibility phase in planning for navigation improvements.

**1.4.2 Engineering Criteria.** Projects should be adequately sized to meet user needs and provide sufficient depth and entrance dimensions for safe access. Engineering during the feasibility phase must be in sufficient detail to provide the basis for the complete project schedule, acquisition of real estate, assessing risk to achieve functional objectives and safety.

**1.4.3 Economic Benefits and Costs.** National Economic Development (NED) benefits, defined principally as effects of a plan that increase the national output of goods and services, must exceed the combined Federal and local costs of constructing, maintaining, and operating the project. Benefits and costs must be

expressed in terms of constant time and value of money. Benefits generally include items such as fuel savings, reduced labor costs, and reduced maintenance costs. Federal interest in the project exists if the benefits exceed the costs, resulting in a benefit-to-cost ratio (B/C) greater than 1.0.

**1.4.4 Environmental Impacts.** Federal laws and environmental regulations require the evaluation of impacts of the project on the environment. Any proposed plan must be consistent with the State's Coastal Zone Management Program and State and local plans. Fish and wildlife impacts are assessed in coordination with the U. S. Fish and Wildlife Service and National Marine Fisheries Service. Their report is provided pursuant to the Fish and Wildlife Coordination Act, as amended. Other environmental requirements are given in the Clean Water Act, National Historic Preservation Act, Threatened and Endangered Species Act and others. Corps of Engineers policy requires that any study identify and pursue opportunities for environmental enhancement and/or environmental restoration. The effects of each alternative on the social and natural environment must be evaluated and the information provided to the public for review. This report contains the Environmental Assessment to satisfy the requirements of the National Environmental Policy Act of 1969.

**1.4.5 Non-Federal Partner Interests.** The alternative must be acceptable to the non-Federal partner. The level of the partner's interest in and support for the recommended alternative must be assessed as well as his financial capability to fund its share of the cost to implement the project.

## **1.5 Prior Studies and Reports**

**1.5.1 Prior Studies and Reports.** Navigation improvements to Charleston Harbor were initially authorized by the River and Harbor Act of 1852. For a listing of prior studies and reports refer to Exhibit A at the end of this report.

**1.5.2 Reconnaissance Study.** The reconnaissance phase of this study was completed with the signing of the Federal Cost Sharing Agreement (FCSA) by the Corps and the SCSPA on April 13, 1993. The study determined that Federal interest existed for a 42 foot channel and that there was a willing partner for the feasibility phase. By signing the FCSA, the South Carolina State Ports Authority agreed to proceed with the feasibility phase of the study.

## **2. Study Area Description**

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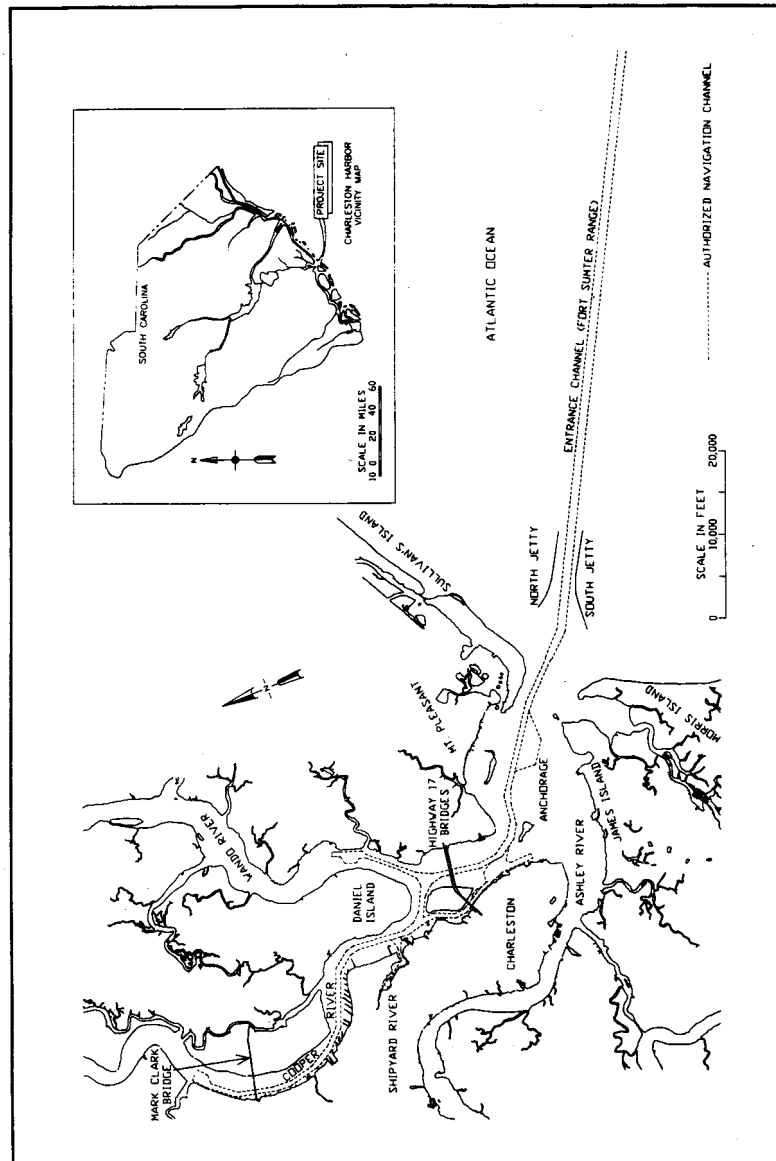
### **2.1 Regional Characteristics**

**2.1.1 Location.** The harbor is approximately 14 square miles in area and lies almost midway along South Carolina's Atlantic Coast. This tidal estuary is fed by the Ashley, Cooper, and Wando Rivers. The harbor is flanked by the City of Charleston on the western shore; James Island, a residential community, and Morris Island, a barrier island used as a dredged material disposal area, on the south; the community of Mount Pleasant and Sullivan's Island, a developed barrier island, on the north; and the Atlantic Ocean on the east. Figure 1 shows the study area. The entrance to the harbor is protected by two granite, rubble mound jetties, 2900 feet apart, which spring from Sullivan's Island to the north and Morris Island to the south. Its location along the South Atlantic Seaboard permits ready access to European and South American ports. The harbor's size and location are incentives to recreational boating activities.

**2.1.2 Climate.** At Charleston, continental air masses from the west are moderated by mixing with marine air masses from the Atlantic Ocean. Summers are warm and winters are relatively mild with average temperature in January of 48°. Relative humidity is fairly high in the area because of the influence of the Atlantic Ocean. The area's severest weather comes in the form of violent thunderstorms, tornadoes, and hurricanes. Most tornadoes occur from March through June with April being the peak month. The hurricane season extends from June to November producing infrequent storms which affect the study area. The average annual precipitation is 51.6 inches. The highest precipitation occurs during the months of March through September. The maximum amount of rain in 24 hours was 9.4 inches in June 1973 (Department of Commerce [DOC 1992]).

**2.1.3 Topography and Geology.** The study area is located in the southern part of the Atlantic Coastal Plain, a physiographic area characterized by meandering rivers, wetlands, and low-lying peninsulas and islands. Most of the land in the Coastal Plain is between 0 and 40 feet above mean sea level (MSL), although some areas to the north may reach 100 feet above MSL.

The geology of the Charleston region is characterized by a series of Pleistocene and recent surficial beach ridge sediments. Recent and Pleistocene sands, silts, and clays are underlain by the Cooper Marl, a brownish green, calcareous, massive clay unit with good load-bearing capacity. The depth to the Cooper Marl varies across the region. Results of soil borings throughout the study area indicates that





the top of the marl occurs at 35 to 40 feet below land surface. The middle Eocene Santee Limestone underlies the Cooper Marl, extending downward approximately 250 feet below the marl. The material encountered above the marl is typically very soft organic clay.

## **2.2 Economic Base**

The Charleston economy relies heavily on the tourism and recreation market. The Charleston Peninsula provides luxury hotels, fine dining, historic setting, and unique retail stores. With the temperate climate, water related sports are enjoyed year round. The nearby barrier islands have some of the finest beaches in South Carolina suited for surfing, sailing, kayaking, and other water sports. Both commercial and sport fishing are abundant along the entire state coast. In addition, shrimp, blue crabs, and oysters are among the local favorites.

Charleston also has a strong military tie. The Charleston Air Force Base, Charleston Navy Base and Shipyard, and Naval Weapons Station are all located within Charleston County. By the end of 1996 the Naval Base and Shipyard will be decommissioned as part of the recent military base closures. The recently opened Strategic Logistic Mobility Base (SLMB) and the 1340th Major Port Command are the main Military users of the Port. The SLMB will be home base for up to 18 large cargo ships loaded with everything required to put a mechanized infantry brigade in the field. The vessels will be cycled in and out of Charleston for servicing of the cargo on board.

Charleston is home of some of the finest medical facilities and institutions of higher learning in South Carolina. Among the medical facilities located on the Peninsula are the Veterans Administration Hospital, Bon Secours - St. Francis Xavier Hospital, Roper Hospital, Charleston Memorial Hospital and the Medical University of South Carolina. The College of Charleston, The Citadel, Johnson and Wales, Trident Technical College, Limestone College, Webster University, Nielson Electronics Institute, Central Wesleyan, and Charleston Southern University provide the community with the opportunity for college educations.

Industrial development in the study area includes the WestVaco paper plant, Bayer Corporation, Amoco, Robert Bosch Corporation and others. A NUCOR steel mill is scheduled for construction in Berkeley County and will add iron carbide to the imports coming into Charleston Harbor.

**2.2.1 Commerce.** Charleston Harbor is the largest and most important seaport in South Carolina and is ranked as the second largest container port on the East Coast and Gulf Coast of the United States. In 1994, more than 10 million short tons of waterborne commerce was moved through the harbor. The most important

export products are coal, chemicals, paper, grain, wood pulp, cement, textiles, and lumber. Petroleum products, chemicals, bauxite and non-ferrous ores are the major import commodities for Charleston Harbor. Two-thirds of this traffic was containerized cargo.

**Figure 2**  
**Evergreen Container Vessel**



In the past two decades, the size of the vessels that used the terminal facilities of Charleston has increased. Design drafts of containerships continue to increase beyond the presently authorized channel depth of 40 feet. At present these vessels must light load or make use of the tidal advantage due to restricted channel depths. The depth of the harbor also impedes the introduction of larger vessels into the fleet that calls on Charleston despite the efficiency gains that can be realized with larger vessels. The dimensions of the existing channel were based on a design vessel with a 810-foot length and a 36-foot draft. The largest container vessels presently coming to Charleston Harbor are 965 feet in length with a draft of 44 feet. The frequency of these vessels calling on Charleston Harbor continues to increase. Most of the largest vessels that call on Charleston are containerships; however, a large number of bulk carriers and tankers also call on the Port. Charleston's demand for container trade has grown dramatically since its introduction in the mid-1960's and is expected to grow in the future.

### **3. Plan Formulation**

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#### **3.1 Overview**

Plan formulation is a process for identifying problems, needs, and opportunities, formulating alternative plans and evaluating those plans to determine which best meets the planning objectives.

#### **3.2 Existing Project and Environmental Conditions**

**3.2.1 Existing Federal Navigation Improvements.** The Federal navigation project for Charleston Harbor includes channels, jetties, contraction dikes, and dredged material disposal areas. They were constructed in partnership with the South Carolina State Ports Authority and are described in detail in the following paragraphs.

**Jetties.** The entrance to Charleston Harbor is flanked by dual-jetty weir systems 2900 feet apart. Construction of these rubble mound jetties was completed in 1895. The south jetty, which springs from Morris Island, is 19,104 feet in length. The north jetty extends seaward from the southern end of Sullivans Island and is 15,443 feet in length. These jetties were constructed to enhance navigation in Charleston Harbor by reducing the shoaling within the channel. The elevation of the jetties is approximately 12 feet above mean low water (MLLW) with the ends extending from station 0+00 to station -112+00 of the Federal navigation channel. The weir portion of the jetties rests just below MLLW from the islands to approximately station 0+00 of the entrance channel.

**Deep Draft Channel.** The present channel depth of 40-feet below MLLW within the harbor and 42 feet in the entrance channel was authorized under PL99-662 (Water Resources Development Act of 1986). Construction began in 1988 and was for all practical purposes completed in September 1994 with construction of the 1550 foot extension of the Wando River channel. In addition to the main portion of the present project, the Tidewater, Upper and Lower Town Creek Reaches plus the Wando River are also included in the Federal navigation channel. The entrance channel is 1000 feet wide from station 0+00 to -700+00 near the 42-foot ocean contour. The width of the channel in the inner harbor varies throughout the remaining 16 miles of navigational channels. The length and width of each channel reach is shown in Table 1. All channels have a 4:1 side slope. The entire Federal navigation channel is comprised of 27 individual reaches. These reaches vary from less than one quarter of a mile in length to more than 11 miles. Sharp and frequent bends contribute to the difficulty of navigating the larger vessels currently porting at Charleston. Meeting and passing is routinely performed within the entrance channel

**Table 1  
Existing Project Dimensions**

Section of Waterway	Depth (Feet)	Width (Feet)	Channel Length (Miles)
Fort Sumter Range	42	1000	11.36
Mount Pleasant Range	42	600-1000	1.89
Rebellion Reach	40	600	2.17
Folly Reach	40	600	0.62
Shutes Reach	40	800	0.34
Horse Reach	40	800	0.98
Hog Island Reach	40	600	1.17
Drum Island Reach	40	600	0.96
Myers Bend	40	800	0.47
Daniel Island Reach	40	600	1.20
Daniel Island Bend	40	700	0.65
Clouter Creek Reach	40	600	1.33
Navy Yard Reach	40	600-675	1.05
North Charleston Reach	40	500	1.02
Filbin Creek Reach	40	500	0.86
Port Terminal Reach	40	600	0.62
Ordnance Reach	40	1400	0.43
Custom House Reach	40	Varies	0.37
Town Creek -			
Upper	40	500	1.23
Lower	40	400	1.02
Turning Basin	40	1400	
Tidewater Reach	40	630	0.82
Shipyard River -			
Entrance Channel	38	300	0.53
Basin A	38	700	0.15
Connector Channel	30	200	0.55
Basin B	30	500	0.17
Wendo Channel	40	400	2.37
Wendo Turning Basin	40	1400	
Anchorage Basin	35	2250	1.40

and other reaches in the lower harbor where sufficient channel width and reach length provide for safe navigation. Three turning basins are located at various terminals in the harbor including: Columbus Street Terminal (Custom House Reach), Wando Terminal and the North Charleston Terminal as referenced in Figure 2. These turning basins are maintained to the project depth.

**Shipyard River.** Shipyard River navigational channel was originally authorized by the River and Harbor Act of 3 July 1930. The initial depth was 20 feet to Basin A and 10 feet deep from Basin A to Basin B. Shipyard River Entrance Channel and Basin A are currently authorized and constructed to 38 feet. The connector channel and Basin B are 30 feet deep. Location of the channels in Shipyard River relative to Charleston Harbor channels are shown in Figure 1 and Plate 1.

**Anchorage.** An anchorage basin is located adjacent to Rebellion Reach (see Figure 1). This area is 2250 feet wide and nearly 7400 feet long. The authorized depth of this anchorage is 35 feet MLLW. The anchorage basin was authorized by the River and Harbor Act of 2 March 1945.

**3.2.2 Project Maintenance.** The existing project is maintained to the authorized project depth of 40 feet MLLW (42 feet for the entrance channel) and 38-feet in Shipyard River. In addition, two-feet of advanced maintenance and two-feet of allowable overdepth are authorized. Shoaling frequently occurs in particular reaches. Plate 1 illustrates the location of the prominent shoals throughout the project limits. The shoal in the Drum Island Bend and Drum Island Reach requires dredging on almost a six-month cycle. In addition to the shoaling problem, this area is difficult for large, less maneuverable vessels to navigate because of the combination of the shoal, the bend - the first turn of a tight S-turn, and the currents. Other reaches with significant shoaling problems are the Wando Terminal Extension, Shipyard River, Lower Town Creek, Daniel Island Reach and Custom House Reach. Dredging records from 1988 to 1994 indicate the average annual maintenance dredging quantities to be approximately 1.8 million cubic yards throughout the inner harbor. This material is placed in upland disposal sites located throughout the study area (see Plate 2).

Maintenance dredging is also performed in the berthing areas of the private terminals and Navy piers. Dredging in the inner harbor is typically done by pipeline dredges. Hopper dredges are used to maintain the entrance channel. Clamshell dredges have been used to load barges to transport inner harbor material to the Ocean Dredged Material Disposal Site (ODMDS).

**3.2.3 Disposal Sites.** The current dredged material disposal sites for Charleston Harbor are: Drum Island, Morris Island, Clouter Creek, Yellowhouse

Creek, Naval Weapons Station, and the Ocean Dredged Material Disposal Site (see Plate 2). The size of the upland sites are listed in Table 2.

**Table 2**  
**Size of Upland Disposal Sites**

<b>Disposal Site</b>	<b>Acres</b>
Morris Island	527
Drum Island	138
Clouter Creek	1,488
Yellowhouse Creek	600
Naval Weapons Station	290

**Site Descriptions -**

**ODMDS** - The Charleston Ocean Dredged Material Disposal Site is located South-West of the entrance to Charleston Harbor and was designated for use of disposal of dredged material on August 3, 1987. In addition, a second site was also designated specifically for disposal of harbor deepening material. The Charleston ODMDS was three square miles in size and averaged 11 meters in depth. The Charleston Deepening site had an interim designation for a seven-year period, was 11.8 square nautical miles in size and averaged 11 meters in depth. The Charleston ODMDS was located totally within the boundaries of the larger deepening site. On October 23, 1995, the Environmental Protection Agency modified the language for the designated use of the larger deepening site from "seven years" to "continued use". Additionally, the smaller Charleston ODMDS was dedesignated in order to protect the natural resources found within its boundaries. For this project, the larger (originally the deepening site) disposal area will be used for disposal of both new work and maintenance material from the entrance channel and inner harbor reaches.

**Morris Island** - Morris Island is a barrier island south of the Charleston Harbor entrance channel. This disposal area was created by using hydraulic dredges to place insitu material along perimeter dikes from within the disposal area. These initial dikes were constructed in 1969/70. The site is divided into two cells. The northern cell is approximately 168 acres with an average interior elevation of approximately 15.8 MLLW, and the surrounding containment dikes have an approximate top elevation of 24.1 MLLW. The southern cell is 359 acres in size and has an interior average elevation of approximately 13.1 MLLW with a surrounding containment dike top elevation being approximately 22.0 MLLW. The use of this disposal site has historically been primarily designated for maintenance material from Rebellion Reach and the Anchorage Basin. New work material from Shutes, Folly, Rebellion, and Wando River Reaches have also been placed on Morris Island.

**Drum Island** - This site is located within the inner harbor area, opposite the confluence of the Wando and Cooper Rivers. This site is bordered by Town Creek and the Cooper River. This area was enclosed by dikes having a top elevation of 9.5 feet MLLW in 1954. Material from Town Creek, lower harbor berthing areas, and parts of the Cooper River shoals were placed in this site from 1958 to the present. The life of this site has been well extended due to successful management of dredged material placement. Portions of this site have been released for use as bird rookeries. The present interior elevation of the main area averages about 19.0 feet MLLW and the dike elevation is about 33.0 feet MLLW.

**Clouter Creek** - This area is located along the east bank of the Cooper River East of North Charleston and the Charleston Naval Shipyard. Two-thirds of this site was formerly owned by the U.S. Navy. With the closing of the Charleston Naval Shipyard this site is being transferred to the Corps for continued use of dredged material disposal. The northern third is owned by the SCSPA. This site houses four cells ranging in size from 190 - 460 acres. The Navy managed the South and Middle Cell for placement of material from Navy Base piers and slips. Material from the Federal channel and turning basin has been placed in the remaining cells. The height of the dikes vary in elevation from 23.0 feet MLLW in the North Cell and 16.0 feet MLLW in Highway Cell to 30.0 feet MLLW in the South Cell. Interior elevations vary from about 20.0 feet MLLW in the South Cell to about 12.0 feet MLLW in the Highway Cell.

**Yellowhouse Creek** - This site is located on the east bank of the Cooper River to the east of the Naval Weapons Station. Maintenance material from the Naval Weapons Station piers and channels has been placed in this disposal site since 1964. The diked area is approximately 600 acres with

dike average elevation of 19.0 feet MLLW and interior elevation average elevation of 12.9 feet MLLW.

**Naval Weapons Station** - This disposal area is located at the south end of the Naval Weapons Station on the west bank of the Cooper River. This site has been used for disposal of material from the Naval Weapons Station channel since 1960. This site is owned by the U.S. Navy and currently under license to the Corps until the year 2010. The dikes enclose an area of approximately 290 acres with average interior elevation of 10.0 feet MLLW and dike elevation of 22.0 feet MLLW.

**3.2.4 Environmental Conditions.** The environmental conditions of the Charleston Harbor estuary system are briefly described below with detailed discussion provided in the environmental documents located at the end of this report.

**Physical Features.** The harbor is a tidal estuary fed by the Cooper, Ashley, and Wando Rivers. The areas surrounding the harbor have topographic relief which lend to the existence of marsh areas. Sullivan's Island and Morris Island have marsh areas of up to one mile in width between the islands and the adjoining mainland. The harbor contains approximately 5,200 acres of regularly flooded marsh, the Wando 6,400 acres, the Ashley 4,300 acres, and the Cooper 9,200 acres. Intertidal, emergent wetlands are the most conspicuous class of wetlands in the study area. These include salt and brackish water marshes. The low salt marsh is monospecific, being vegetated with smooth cordgrass. The high marsh, which occurs above mean high water (MHW), is flooded irregularly by spring and storm tides, and has a varied plant composition. Plants which grow in salty soil include halophytes which occur in abundance include black needlerush, saltwort, sea lavender, and marsh aster.

Brackish water marshes represent a transition zone between salt marshes and tidal freshwater marshes. Plant species found in the more seaward brackish marshes are quite similar to those of the upper high marsh zone of the salt marsh. Pure stands of black needlerush may occur in these marshes. Saltwater bulrush, aster, marsh elder, sea-myrtle, panic grass, saltmeadow cordgrass, sea ox-eye, broomsedge, and seaside goldenrod also may be present. Giant cordgrass occasionally appears along upland borders of the more seaward brackish marshes. As salinity decreases, giant cordgrass generally replaces needlerush as the dominant plant.

These emergent wetlands are highly productive natural systems that provide spawning, nursery, and feeding habitat for important commercial finfish and



shellfish, and most marine sport fishes inhabit estuarine areas during all or part of their life cycles. Estuarine emergent marshes also provide valuable habitat for various waterfowl and other wildlife species, including wading birds, shorebirds, and mammals such as the marsh rabbit, marsh rice rat, river otter and mink.

Estuarine intertidal shorelines, sand bars, and mud flats are classified as intertidal, unconsolidated shore; these are typically grouped together as intertidal flats. Intertidal flats are composed of sandy and muddy sediments in a wide range of relative proportions. Intertidal flats also provide valuable habitat for benthic invertebrates which are heavily preyed on by fish, wading birds, and shorebirds. Estuarine, intertidal, reef habitat is represented primarily by oyster reefs occurring in estuarine intertidal zones. The American oyster can tolerate a wide range of salinity, temperature, turbidity, and oxygen tension and is, therefore, adapted to the periodic changes in water quality that characterize estuaries. Oysters often build massive, discrete reefs in the intertidal zone. Oyster reefs occur throughout the project area but are closed for recreational and commercial harvest due to unacceptable water quality. Water quality in the Wando River upstream of the Wando terminal is suitable for shellfish harvest.

**Fish and Shellfish.** Fishery resources within Charleston Harbor and the project area consist of numerous estuarine and marine species. Demersal fish species which are typically associated with the lower water column and substrate of Charleston Harbor include Atlantic croaker, bay anchovy, Atlantic menhaden, spotted hake, weakfish, spot, blackcheek tonguefish, white catfish, and silver perch. Other fish which are of commercial or recreational value and are commonly found within Charleston Harbor include flounder, red drum, spotted seatrout, bluefish, spot and black drum.

Six anadromous fish species, Atlantic sturgeon, shortnose sturgeon, American shad, blueback herring, hickory shad, and striped bass, and one catadromous species, American eel, utilize Charleston Harbor and its tributaries as migration routes and spawning areas. Fishes which commonly reside within the intertidal marshes of the project area include mummichog, sheepshead minnow, Atlantic silverside, and bay anchovy. Other species which frequent intertidal marshes include both species of mullet, croaker, and numerous species of food fish. Tidal pools in the high marsh area are inhabited by species such as sailfin molly and mosquitofish. Charleston Harbor estuary supports large populations of penaeid shrimp and blue crab which are harvested both commercially and recreationally. The shrimp fishery is South Carolina's largest commercial fishery, averaging 3.24 million pounds (\$11.8 million) annually during recent years. The Charleston Harbor estuary contributed approximately 20% of the state's total 1978-1987 shrimp landings. Annual commercial landings of blue crab averaged 6.17 million pounds (\$1.8 million) during recent years, with Charleston Harbor accounting for about 8% of the statewide total.

The majority of the upland areas around Charleston Harbor contain either residential or commercial development. Daniel Island, which extends northward from the confluence of the Cooper River and Wando River, supports agricultural activities and a diversity of wildlife habitats. The majority of remaining undeveloped upland areas adjacent to the harbor are presently serving as dredged material disposal sites.

**Water Quality.** Water quality in Charleston Harbor is classified as SB by the South Carolina Department of Health and Environmental Control (SCDHEC). The SB rating applies to tidal salt water suitable for primary and secondary contact recreation, crabbing, and fishing, except for the harvesting of clams, mussels, or oysters for market purposes or consumption. These waters are also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora. Waters rated as SB should not have dissolved oxygen concentrations less than 4 mg/l and fecal coliform concentrations should not exceed a geometric mean of 200 colonies/100 ml based on five consecutive samples taken within a 30 day period.

Although these concentrations have been exceeded occasionally, recent review of data collected by SCDHEC indicates that water quality within the harbor basin often meets SB standards for dissolved oxygen and fecal coliform levels.

Water quality in the Wando River is classified SFH (Shellfish Harvesting Waters) for the portion of the river from its headwaters to a point 2.5 miles upstream of its confluence with the Cooper River. This classification applies to tidal saltwaters protected for shellfish harvesting. SFH water must maintain a daily average dissolved oxygen concentration of 5 mg/l or higher with a low of 4 mg/l and have median coliform concentrations of 14 colonies/100 ml with no more than 10% of the samples exceeding 43 colonies/100 ml. For the portion of the Wando River from its confluence with the Cooper River to a point 2.5 miles upstream, the river is classified as SA waters. SA waters have the same designated uses as SB waters, although the water quality standards are stricter for dissolved oxygen. SA waters require a daily average of dissolved oxygen of not less than 5.0mg/l with a low of 4.0 mg/l.

**Sediment Analysis.** Materials in the entrance channel include overburden deposits which consist of: High plasticity (fat) clay (CH); low plasticity (lean) clay (CL); high plasticity silt (MH); low plasticity silt (ML); clayey sand (SC); silty sand (SM); poorly graded sand (SP); poorly graded silty sand (SP-SM); silty clayey sand (SM-SC); other silt, sand and clay mixtures; and silty gravel (GM). The soils often contain varying amounts of small to large shell fragments and shells, fossil fragments, gravel, rock fragments, and cemented sand or silt nodules. The consistency of relative density of materials to be dredged varies. Although some

soft or loose sediments including clays, silts, sands, and shell may exist, primarily in the superficial or upper deposits, most of the subsurface materials range from stiff or medium dense to hard or very dense sediments with some layered very soft to hard limestone and/or limestone gravel. In many areas, these dense to very dense sands and stiff to hard clays are several feet thick, often calcareous and partially indurated or cemented, have high blow counts, and are expected to be difficult to remove. Previous experience has shown that rock cutting equipment may be required for efficient removal of the limestone rock encountered and, possibly, some of the dense or very dense partially cemented sands and very stiff to hard silts and clays in the entrance channel.

The soils encountered for the deepening of the inner harbor can be divided into three separate groups: overburden soils, the Cooper Marl formation, and Coquina.

a. **Overburden Soils.** Overburden soils consist of sands, silts, clays, and loose shell formations overlying the predominate Cooper Marl or coquina. Predominate overburden soils are recent organic clayey silts (MH/OH) and fine sands (SP) and silty fine sands (SM) with varying shell content. The overburden soils are typically loose in the case of granular deposits and soft to very soft for cohesive deposits. These soils are encountered for the full length of a 20-foot vibracore at scattered locations from station 36+00 to station 829+00.

b. **Cooper Marl.** The Cooper Marl formation is found extensively throughout the harbor. The marl is an overconsolidated, fine grained, hard to very hard calcareous deposit containing glauconite and characterized by phosphatic nodules in the lower portion. Generally, the marl is less than 200 feet thick, although greater thicknesses are found. The marl at the project site is composed primarily of an olive-brown to olive sandy clayey silt (ML/MH) with occasional layers of very silty clayey fine sand (SM/SC).

c. **Coquina.** Overlying the Cooper Marl at some locations is a light gray calcareous cemented sandy shell that has been geologically referred to as Coquina. This formation is found primarily in the entrance channel. The degree of cementation can vary from weakly cemented to strongly cemented.

**Threatened and Endangered Species.** A complete listing of threatened and endangered species in the subject project area was provided by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. This listing is located on page 4 of the Environmental Assessment.

**Cultural Resources.** The city of Charleston, South Carolina, is situated on a narrow peninsula at the confluence of the Ashley and Cooper Rivers. Historic and cartographic research has confirmed that the Charleston Harbor area has been one

of the most important ports in the south since its founding in the late seventeenth century. The city is one of the oldest permanent settlements in the United States and has many areas and structures of great significance in the history of the country from the Revolutionary War and Civil War to the reconstruction period. Prominent historical structures in Charleston Harbor include Fort Sumter, a former coastal fortification known for its role in the Civil War and Shute's Folly Island (Castle Pinckney), a military fortification dating back to 1799. Figure 3 shows the castle as seen today. The high level of maritime commerce and transportation associated with Charleston history confirms the important role of Charleston Harbor and its rivers to the development of the city, and as a result, those waterways should be considered high probability areas for submerged cultural resources associated with Charleston's maritime heritage. In anticipation of the proposed improvements to Charleston Harbor, the Charleston District has conducted for an archaeological remote sensing survey and documentation of effected portions of the harbor channel.

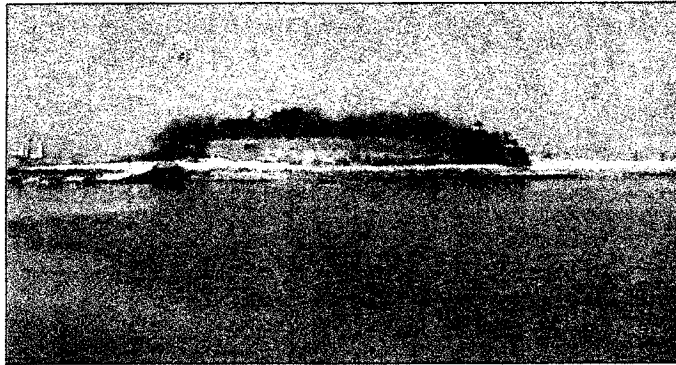


Figure 3: Castle Pinckney on Shutes Folly Island

**3.2.5 Port Facilities.** Charleston Harbor is a modern intermodal transportation hub, shipping and receiving bulk, breakbulk, containerized and other cargo from around the world. Major terminal facilities, shown in Figure 4, are described below. Table 3 lists the Oceanic lines and destinations for October 1995 at the port of Charleston.

Containerized cargo is handled at three terminals: North Charleston Terminal, Columbus Street Terminal and Wando Terminal. Figure 5 pictures an Evergreen container vessel at the North Charleston Terminal while Figures 6 and 7 show the Columbus and Wando Welch Terminals. These terminals have about 1.5 miles of combined berthing space, with 18 container cranes, 7 traveling bridge cranes, and

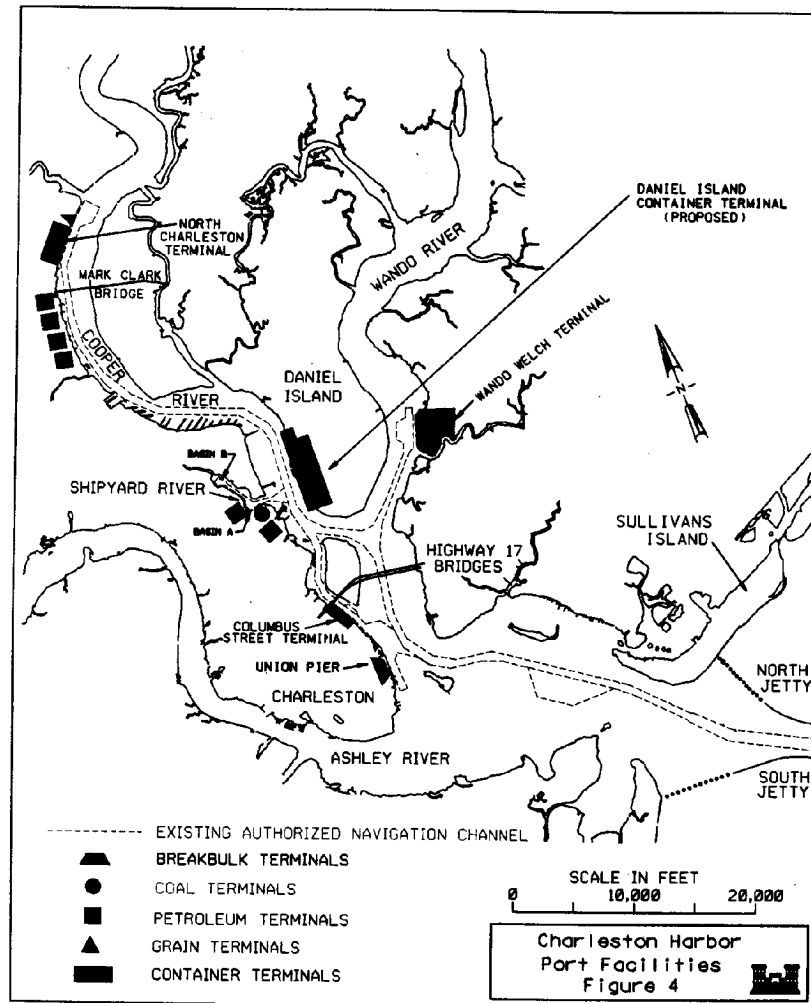




Figure 5: North Charleston Terminal

36 top-lift cranes typical of those shown in Figure 8. The North Charleston and Columbus Street terminals have rail and truck access; the Wando Terminal has truck access only. The North Charleston and Wando terminals handle only containerized cargo; Columbus Street handles some breakbulk and roll-on/roll-off (ro/ro) cargo. The State Ports Authority has purchased land on Daniel Island to develop a fourth container terminal, designed to have seven 1000-foot berths. Two berths are expected to be operational by 2003; the remaining berths will be completed in several phases as they are needed. When complete, the terminal will have a total annual capacity of 25 million tons.

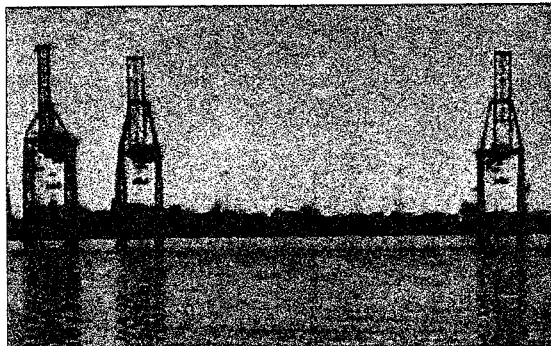


Figure 6: Columbus Street Terminal

The Union Pier Terminal is Charleston's primary handler of ro/ro cargo. This terminal also handles breakbulk cargo, and is equipped with one 30-ton gantry crane. Rail service at the pier provides drive-on/drive-off access to ro/ro vessels.

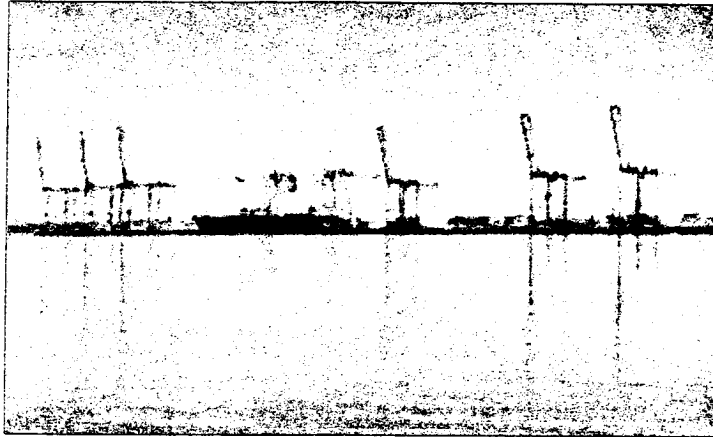


Figure 7: Wando Welch Terminal

Petroleum products are received at six berths located along the Cooper River between Myers Bend and the North Charleston Terminal. Since there are no petroleum product pipelines serving the coastal regions of South Carolina, nearly all gasoline and other petroleum products consumed in the region arrives by ship in Charleston Harbor. Petroleum product terminals are equipped with numerous land side holding tanks for storage and distribution.

Table 3

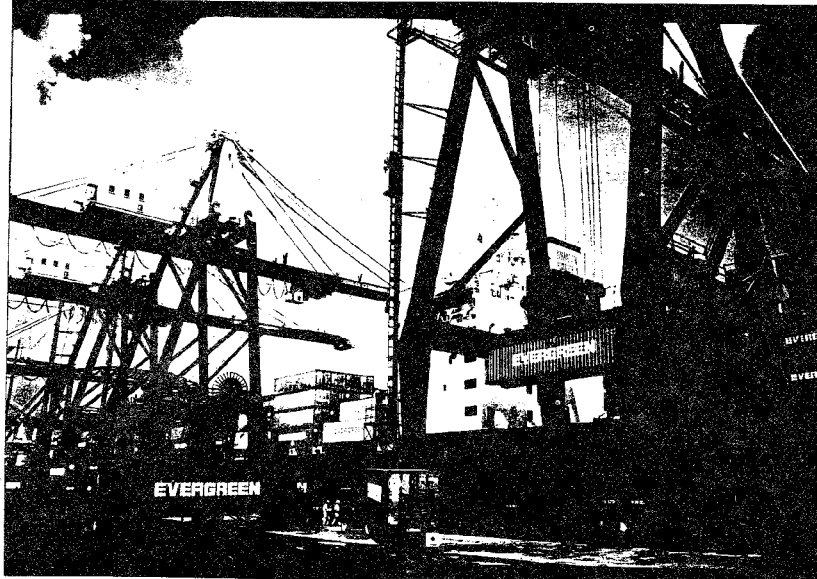
# STEAMSHIP SERVICE PROFILE

Oceanic Shipping Services Offered at the Port of Charleston

LINE	AGENT	FREQ.	PIER	CARGO	LINE	AGENT	FREQ.	PIER	CARGO
<b>Africa (East-South-West)</b>					<b>South America</b>				
Farrell Lines	FA	11 Days	WA	B-C-RE	Maersk Line	M	4 Calls/Week	WA	C-RE
HUAL	P	10 Days	UP	R	Mediterranean Shipping	MSC	Weekly	NC	B-C
Italia Line	I	Weekly	WA	C-R	Nedlloyd Lines	N	Weekly	WA	C-RE
Lykes Bros.	L	Weekly	NC	B	Nordana Line	WE	17 Days	CS	B-C-R
Maersk Line	M	4 Calls/Week	WA	C-RE	OOCL	O	2 Calls/Week	WA	C-RE
Mediterranean Shipping	MSC	Weekly	NC	B-C	P&O Containers Ltd.	PO	Bi-Weekly	WA	B-C
Nedlloyd Lines	N	Weekly	WA	C-RE	Sea-Land	SL	4 Calls/Week	WA	C
P&O Containers Ltd.	PO	Bi-Weekly	WA	B-C	D.B. Turkish Cargo	I	12 Days	CS	B-C
SafBank	GA	Weekly	NC	C-RE	Zim Line	BR	Monthly	CS	B-C
<b>Australia-New Zealand</b>					<b>U.K.-N. Europe-E. Europe-N. Russia</b>				
ABC Containerline	AR	16 Days	NC	C-RE	ABC Containerline	AR	16 Days	NC	C-RE
COSCO	NL	Weekly	NC	C-RE	Atlantic Container Line	I	Weekly	NC	B-C-RE
Maersk Line	M	4 Calls/Week	WA	C-RE	AtlantCargo	STR	8 Days	NC	B-C
Mediterranean Shipping	MSC	Weekly	NC	B-C	Depepe Lines	C	Weekly	WA	C
Neptune Orient Line	TR	Weekly	WA	C-RE	Evergreen	EM	2 Calls/Week	NC	C-RE
NYK Line	NYK	Weekly	WA	C	Gorthon Line	P	Monthly	UP	B
SafBank	GA	Weekly	NC	C-RE	Hapag Lloyd	C	Weekly	CS	B-C-RE
<b>Far East-Indonesia-Southeast Asia</b>					HUAL	P	10 Days	UP	R
ABC Containerline	AR	16 Days	NC	C-RE	Hyundai Marine	P	Bi-Monthly	UP	B
Am. President Line	APL	Weekly	CS	C-RE	Maersk Line	M	4 Calls/Week	WA	C-RE
COSCO	NL	Weekly	NC	C-RE	Mitsui O.S.K. Line	MOL	Weekly	CS	C-RE
Evergreen	EM	Weekly	NC	C-RE	Nedlloyd Line	N	Weekly	CS	C-RE
Hapag Lloyd	C	Weekly	WA	B-C-RE	Neptune Orient Line	TR	Weekly	WA	C-RE
HUAL	P	10 Days	UP	R	NYK Line	NYK	Weekly	WA	C
Hyundai Marine	P	Bi-Monthly	UP	B	OOCL	O	10 Days	CS	C-RE
Maersk Line	M	4 Calls/Week	WA	C-RE	P&O Containers Ltd.	PO	Bi-Weekly	WA	C-B
Mitsui O.S.K. Line	MOL	Weekly	CS	C-RE	Pan Ocean	I	Monthly	UP	B
Nedlloyd Line	N	Weekly	CS	C-RE	Wallenius Line	WA	8 Days	UP	R
Neptune Orient Line	TR	Weekly	WA	C-RE	<b>India-Pakistan-Persian Gulf-Red Sea</b>				
NYK Line	NYK	Weekly	WA	C	Evergreen	EM	Weekly	NC	C-RE
OOCL	O	10 Days	CS	C-RE	Farrell Lines	FA	11 Days	WA	B-C-RE
P&O Containers Ltd.	PO	Bi-Weekly	WA	C-B	Hapag Lloyd	C	Weekly	CS	B-C-RE
Pan Ocean	I	Monthly	UP	B	HUAL	P	10 Days	UP	R
Wallenius Line	WA	8 Days	UP	R	Italia Line	I	Weekly	WA	C-R
<b>West Indies-Caribbean-Central America-Mexico-Bermuda</b>					Lykes Bros.	L	Weekly	WA	B-C-RE
AtlanticCargo	STR	8 Days	NC	B-C	Maersk Line	M	4 Calls/Week	WA	C-RE
CSAV-Chilean Line	OF	Weekly	NC	B-C-RE	Mediterranean Shipping	MSC	Weekly	NC	B-C
Evergreen	EM	Weekly	NC	C-RE	Nedlloyd Line	N	Weekly	CS	C-RE
Farrell Lines	FA	11 Days	WA	B-C-RE	Neptune Orient Line	TR	Weekly	WA	C-RE
Grancolombiana	NL	10 Days	NC	B-C-RE	NYK Line	NYK	Weekly	WA	C
Hapag Lloyd	C	Weekly	CS	B-C-RE	P&O Containers Ltd.	PO	Bi-Weekly	WA	B-C
Lykes Bros.	L	Weekly	WA	B-C-RE	Sea-Land	SL	4 Calls/Week	WA	C
Maersk Line	M	4 Calls/Week	WA	C-RE	Shipping Corp. of India	NL	Weekly	CS	C
Nedlloyd Line	N	Weekly	WA	C-RE	<b>Mediterranean-N. Africa-Black Sea-Atlantic Is.</b>				
Sea-Land	SL	4 Calls/Week	WA	C	ABC Containerline	AR	16 Days	NC	C-RE
TMM	K	Weekly	WA	C-RE	AZSCO	TC	18 Days	CS	B-C-R
<b>Pier Keys</b>					COSCO	NL	Weekly	NC	C-RE
UP Union Pier	CS Columbus Street	WA Wando Welch	B Breakbulk	C Container	Evergreen	EM	Weekly	NC	C-RE
NC N. Charleston			R Ro/Ro	RE Reefer	Farrell Lines	FA	11 Days	WA	B-C-RE

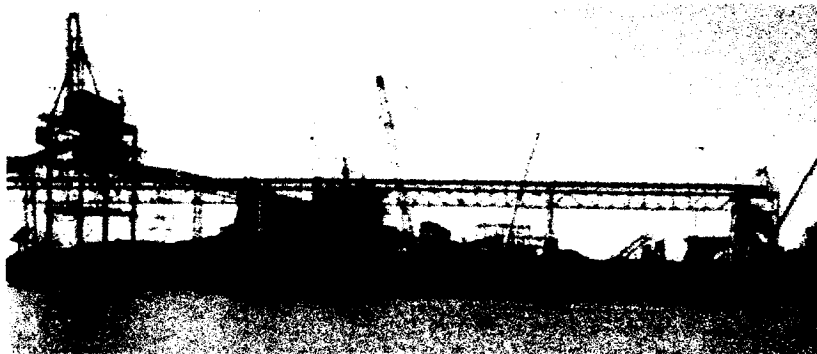


**Figure 8**  
**Container Terminal Cranes**



Coal has been exported from the Shipyard River Coal Terminal (SRCT) in Charleston since the coal terminal became operational in 1983. SRCT is served by CSX and Norfolk Southern railroads, and has on-site blending capabilities. The facility is equipped with ten conveyor belts, an underground reclaimer tunnel, a radial stacker, three car dumpers, and land-side storage areas that can accommodate about 300,000 tons of coal (See Figure 9). The maximum annual capacity of this terminal is 4 million tons.

**Figure 9**  
**Shipyard River Coal Terminal**



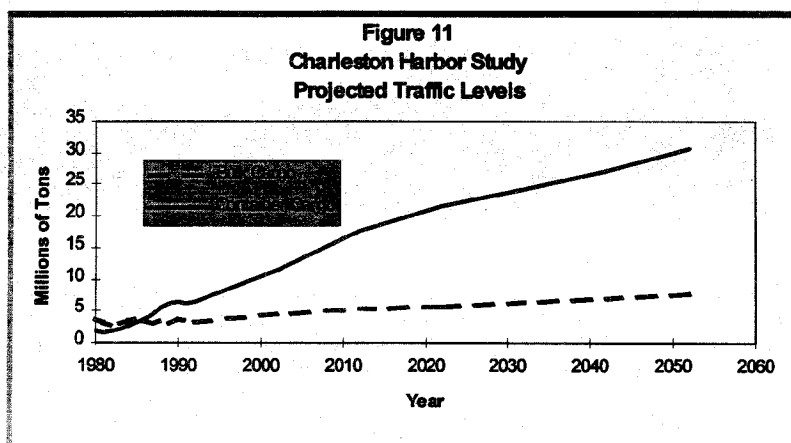
The grain terminal is located near the upstream limits of the Federally maintained channel on the Cooper River. On-site facilities include a grain elevator with 50 concrete silos and other storage facilities with a combined capacity of 1.6 million bushels. Grains are moved by means of a 42-inch conveyor belt from the silos to the gallery, which extends the full length of the wharf and serves five vessel-loading spouts. This terminal is served by both rail and truck. (See Figure 10)

**Figure 10**  
**Grain Terminal**



### 3.3 Deep Draft Commerce

**3.3.1 Existing Versus Future Without-Project Overview.** The volume of containerized cargo shipped and received in Charleston Harbor is projected to grow substantially over the period of analysis, while more modest growth is projected in bulk cargo. As reflected in Figure 11, containerized cargo is projected to grow at an average annual rate of 2.7 percent from 1992 to 2052; bulk traffic is projected to grow at an average annual rate of 1.4 percent over the same period.



Since 1993, rapid growth of container traffic has resumed after a period of low growth extending from 1989 to 1993. This rapid growth has been facilitated by institutional changes, such as the increased use of vessel-sharing agreements, and the addition of new berthing space and land side facilities at the Wando Terminal. When the addition to the Wando Terminal was completed in early 1995, one of Charleston's major carriers moved from the Columbus Street Terminal to the new facilities and a new shipping consortium moved into the facilities vacated at Columbus Street. Container traffic increased about 15 percent from 1993 to 1994, preliminary data indicate that container traffic continues to grow rapidly into 1995. The development of a the new terminal on Daniel Island will accommodate all projected future growth of containerized cargo.

**3.3.2 Existing Activity.** Container cargo accounts for about two-thirds of the total traffic and Charleston is the centerpiece of a modern intermodal transportation network, with immediate access to the interstate highway system and CSX and

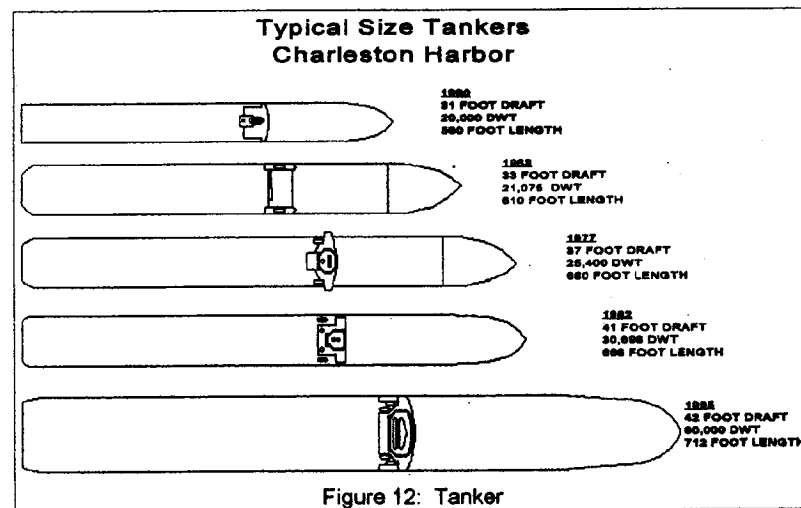
Norfolk Southern railroads. Combined with a well-developed, modern infrastructure to accommodate cargo traffic, Charleston Harbor is a port capable of handling the existing cargo traffic as well as projected growth.

Institutional and structural changes have greatly improved the efficiency of operations in Charleston Harbor. Vessel-sharing agreements have allowed shippers to fully utilize the large vessels that are in use. More recently, groups of shippers have formed large, loosely-allied shipping consortiums to further improve shipping efficiency. The completion in 1995 of a new berth and additional landside facilities at the Wando Terminal allowed the addition of a major new shipping consortium to Charleston Harbor.

### 3.4 Deep Draft Fleet

**3.4.1 Historical Trends.** There are three primary vessel classifications which effect Charleston Harbor: Petroleum Tankers, Dry Bulk Carriers, and Container Vessels.

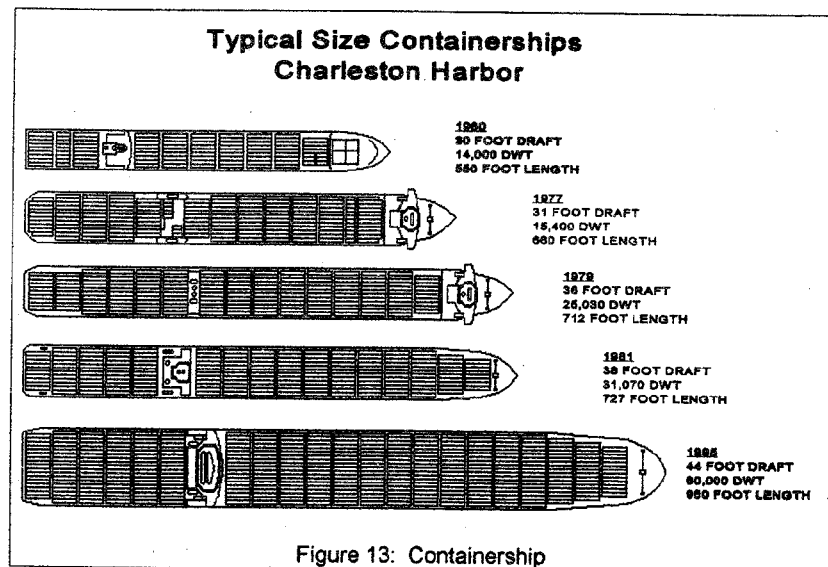
**Petroleum Tankers** - The design drafts of petroleum tankers calling on Charleston Harbor ranged from 31 feet to 44 feet. About 40 percent of the vessels had design drafts of 35 feet to 37 feet. Nearly half had design drafts in excess of 37 feet, with more than one-quarter of all vessels at 42 feet. Figure 12 shows the historical trend in the size of tankers porting at Charleston.



**Dry Bulk Carriers** - These vessels carry grain and coal. For dry bulk carriers transporting grain, in 1993, design drafts ranged from 30 feet to 41 feet. About 25 percent of the vessels had design drafts of 34 feet to 36 feet with another 30 percent having design drafts of 40 feet to 41 feet. The existing coal fleet calling on the coal terminal at Shipyard River has a design draft of 36 feet (25 percent). These vessels require 2 feet of tidal advantage when fully loaded to provide the required four feet of underkeel clearance in the 38-foot channel at Shipyard River.

**Container Vessels** - Design drafts range from 34 feet to 44 feet for container vessels calling on Charleston Harbor from the Pacific Trade Routes (Pacific Ocean and thus, no post-Panamax vessels are found in this segment of the fleet. The vessels from the Atlantic Trade Routes have design drafts ranging from 31 feet to 44 feet with nearly half of the vessels at 37 to 38 feet. Another quarter of the Atlantic fleet had design drafts of 44 feet. Figure 8 shows the historical trend in the size of containerships porting at Charleston.

**3.4.2 Current Operating Practices.** Traffic levels are projected to increase without further investment in Charleston Harbor. As noted above, containerized



cargo is projected to grow at an average annual rate of 2.7 percent from 1992 to 2052; bulk traffic is projected to grow at an average annual rate of 1.4 percent over the same period.

In accordance with anticipated traffic growth, most infrastructure improvements are those associated with the shipment of container cargo. Construction of the first portion of the new container terminal on Daniel Island is scheduled to be completed by 2003. By that time, traffic levels will again be near existing capacity. Within a month of the completion of additional berth space and land side facilities at the Wando Terminal in 1995, Sea-Land moved to the new facilities and a new shipping consortium began using the space vacated by Sea-Land at the Columbus Street Terminal. Similar intra-harbor shifts are likely to occur with the availability of the new facilities at the Daniel Island Terminal.

Without additional depth, Charleston Harbor will continue to impose a constraint on the use of large vessels. Charleston presently attracts some of the largest container vessels in use, but these vessels incur tidal delays and light-loading costs when using Charleston. Most of the shipping companies that operate out of Charleston have additional large vessels on order. One company has ordered eight new container vessels that are scheduled to start calling on Charleston before the turn of the century. All eight of these vessels have design drafts of 41 feet and cannot enter or leave Charleston without incurring tidal delays.

The presence of 44-foot draft vessels in Charleston's container fleet indicates that the depth of Charleston Harbor is not always the determining factor in the design of new vessels. These large vessels are able to make better use of the draft elsewhere in their itinerary. However, vessels with design draft of 37 and 38 feet and involved in trade between North America and Europe, appear to be sized in accordance with the maximum depth available at container terminals on the east coast of the United States. Charleston is the last North American port of call for these vessels. When they reach the end of their economic life shortly after the turn of the century, their replacement with larger, more efficient vessels is likely with increased depth at Charleston Harbor.

### **3.5 Problems and Opportunities**

**3.5.1 Transportation Efficiencies and Delays.** The economic penalties imposed by inadequate channel depth can be severe. For the vessels that currently call on Charleston, operating costs commonly exceed \$2,000 per hour. One foot of light-loading can increase transportation costs by roughly \$1 per ton or more. With more than 1,000 vessel calls each year and more than 10 million tons of cargo, the cost of light-loading and tidal delays in Charleston Harbor can be excessive. The

inability to attract larger vessels further penalizes the cargo in harbors with inadequate channel depth. Another problem in Charleston Harbor is the inability of the 860-foot commercial vessels to pass in various reaches.

The area between Hog Island Reach and Daniel Island Bend presents adverse conditions for safe navigation due to particular channel alignments, shoaling, and severe currents. Pilots experience significant problems in navigating even the 860-foot vessels through the sharp S-turn at the Drum Island Reach situated immediately up river of the Highway 17 bridges. Under ebb tide conditions, this area is plagued with strong currents from the Cooper and Wando Rivers. As inbound vessels make the turn from Hog Island Reach to Drum Island Reach the currents from the Wando River hit the starboard side of the vessel forcing it towards Drum Island. Drum Island Reach is also prone to serious shoaling thus restricting mariners to less than full channel dimensions. Successfully navigating this reach is critical in positioning the vessel to enter Daniel Island Reach. Additional navigational hazards are encountered at the southern end of Daniel Island Reach where three contraction dikes and two piers are located on either side of the channel compounded with the confluence of Shipyard River. Under optimum conditions the existing channel alignment forces vessels to pass very near tankers moored at the Allied petroleum pier creating a possible collision situation with catastrophic consequences (as seen in track plot for Test Reach H under existing conditions at flood tide located at the end of Appendix A). The existing project was designed for two-way traffic for 860-foot length vessels in Daniel Island Reach (See Figure 14). However, even with one-way traffic, the 950-foot length design vessels have difficulty navigating the approach to this reach.

The SPA plans to construct a new commercial container terminal on the Cooper River side of Daniel Island. This terminal will be 7000 feet long with seven 1000-foot berths. The construction of this terminal will further complicate the existing conditions in this reach. Construction of this terminal presented a challenge to provide safe navigation for vessels transiting the waterway as well as protection of docked vessels at the new and existing facilities. A design team consisting of personnel from SPA, WES, District, Division, and Harbor Pilots Association developed various channel design plans. The initial proposed terminal location placed the face of the wharf within 125 feet of the existing Federal channel. This proposal was discarded by the design team after initial simulation runs because of concerns that the plan would add to the existing navigation problems. The location of the southwest corner of the terminal inhibited the vessels turn from Myers Bend to Daniel Island Reach thus forcing the vessels too close to tankers at the petroleum pier. Several design plan alternatives were tested on the ship simulation model before consensus was reached by the design team resulting in the recommended plan described in this report. All tests revealed channel modification was required.

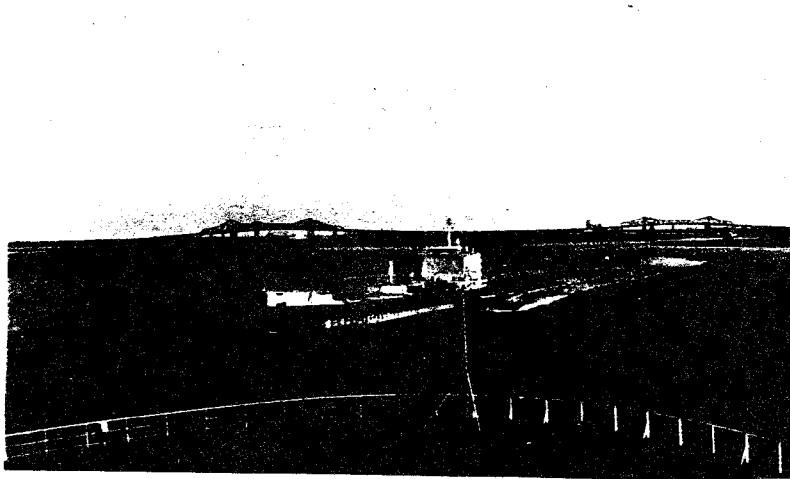
on the east side of the channel. The overall channel dimensions could have been reduced on the west side of the channel if not for the location of the petroleum pier.

The proposed channel realignment in the Daniel Island reach is needed for safe navigation by many of the large vessels that now transit this reach. Pilots currently allow inbound ships whose lengths exceed 900 feet to transit this reach only during flood tide. The existing channel alignment forces these large vessels into a path which presents a significant potential for collision with vessels moored at the Allied Petroleum Terminal, which is used to unload gasoline and other petroleum products from tankers. Such a collision would result in catastrophic economic and environmental losses, and potential loss of life. Track plots from the ship simulation studies demonstrate that the realigned channel is necessary and is used for navigation by inbound vessels destined for the upper reaches of the harbor and outbound vessels departing from the upper reaches.

The recommended widened channel would provide safe conditions for the 950-foot design vessels within the reach while allowing adequate clearance between moored vessels at the petroleum pier and new container terminal. The increase in commercial vessels size and number combined with existing and future navigational obstacles in the Daniel Island Reach warrant a wider channel based on navigational safety.



**Figure 14**  
**Vessels Passing in Daniel Island Reach**



Large vessels passing docked vessels too closely create a suction effect which causes an additional strain on the mooring lines of the docked vessels. Presently, this problem exists when large commercial vessels pass too closely to petroleum tankers are docked at the Allied pier. Large inbound vessels navigating the bends between the bridges and Daniel Island Reach must avoid the shoals in Drum Island Reach while preparing for the turn at Myers Bend allowing adequate distance between moored tankers at the Allied pier. The forces exerted on the moored ships can be reduced by having ship traffic travel at slower speeds. However, strong tidal currents in the Cooper River force that ship traveling with the currents to transit at a fairly high speed to maintain steerage. The new container terminal will contribute to this problem with the increased traffic and the potential of having seven container ships docked at the facility on the opposite side of the river. The location of the terminal is not dependant on traffic operation in the channel.

The design of this channel accounts for the existing and projected physical features associated with the Daniel Island Reach. The wider channel is needed even without the construction of other harbor improvements analyzed in this study to provide safe navigation for the size of the existing and projected commercial vessels utilizing Charleston Harbor. The new terminal is located in the most optimum location for safe navigation while allowing for efficient terminal operation as determined by ship simulations conducted at the Waterways Experiment Station. The terminal could not

be moved any closer to the existing channel without compromising the safety of large commercial vessels traversing the bends around Daniel Island and that of ships docked at the Daniel Island Terminal. The west side of the Daniel Island channel remains in place to accommodate petroleum tankers calling on the Allied pier.

When the Daniel Island container terminal is constructed, there may be problems with channel alignment, stresses caused by passing ships on moored vessels, delays in getting vessels turned or other issues of navigation efficiency or safety that need to be addressed.

Town Creek has been maintained as an alternate route to the main Cooper River Channel since the main channel was relocated from the Town Creek Reach, Tidewater Reach, and South Channel located to the west of Shutes-Folly Island in the 1950's. The need for the alternate channel at the Upper Town Creek Reach, at its present dimensions, no longer exists, therefore this reach was reevaluated.

Opportunities for environmental enhancement and restoration are being explored throughout the study process.

**3.5.2 Planning Considerations.** The Panama Canal cannot accommodate vessels whose actual draft exceeds 40 feet or whose width exceeds 106 feet. This poses one of the most important planning considerations. Containerships trading with Asia are the only vessels calling on Charleston that transit the Panama Canal. The extent to which these vessels benefit from increased harbor depth is restricted by the limits imposed by the Panama Canal. The Post-Panamax vessels exceed these restrictions and are unable to use the Panama Canal. Furthermore, the extent to which the draft of Panamax and smaller vessels can be used in Charleston is constrained by the limits of the Panama Canal.

The depth available at harbors that trade with Charleston is another consideration. A portion of the petroleum product traffic originates at harbors along the Gulf Coast whose depth does not exceed 40 feet. This traffic will not benefit from increased channel depth at Charleston. The Panama Canal is the overriding circumscription for trade with Asia. Most of Charleston's European trading partners have harbor depths that exceed any depth that is being considered in this study and thus impose no restrictions.

The two Highway 17 bridges crossing the Cooper River and Town Creek connecting downtown Charleston with Mount Pleasant pose a concern for possible channel widening. The federal navigation channel was present prior to construction of either the Grace Memorial Bridge or the Silas M. Pearman Bridge. The two-lane Grace Memorial Bridge was built in the 1940's with a support piling span distance of 1000

feet over the navigation channel. The Pearman Bridge was built in the mid-1960's and only has a span distance of 700 feet over the channel.

Concern has been raised by the state highway department that the dredging activity in the immediate vicinity of the Highway 17 bridges has caused scouring around the foundation of the bridges. Hydrographic survey data indicates that scouring occurs at piers far removed from the navigation channel. The studies conducted for the harbor deepening do not support a linkage between channel deepening and pier scour.

**3.5.3 Dredged Material Disposal.** Another planning consideration is the availability of sites for the disposal of dredged material. In developing cost estimates for the construction of the improvements to the channel as well as future maintenance, the availability and capacity of disposal sites was evaluated to assure that the planned use of low-cost sites does not exceed their capacity. When the capacity of a site can be increased by diking, the additional costs of diking was quantified and added to the disposal cost. Upland disposal sites are limited in number and capacity. The cost of placing material in existing upland sites is less expensive than taking the material to the ODMDS for certain reaches located adjacent to upland disposal sites. In order for upland disposal of dredged material to be cost effective, the sites must have substantial capacity and be located adjacent to frequently dredged reaches of the Federal navigation project.

### **3.6 Formulation of Alternatives**

Existing project depth is inadequate to accommodate all the vessels that are projected to call on the harbor without imposing large light-loading and/or tidal delay costs. A deeper harbor will allow the use of larger, more efficient vessels and more efficient use of the large vessels that already call on the harbor. Providing for increased length of two-way traffic reaches, channel configurations more suitable for safe navigation in problematic reaches, and a turning basin for the new Daniel Island Terminal will further improve the efficiency and safety of vessel operations. This study evaluates the economic costs and benefits of (1) channel depths ranging from 41 feet to 46 feet, (2) two-way traffic areas on the Wando River and in the Shutes and Folly Reaches of the main channel, and (3) a turning basin for the new Daniel Island Terminal. Separable increments of the channel deepening alternatives were evaluated incrementally. These increments are (1) the entrance channel and the main channel on the Cooper River to the North Charleston Terminal, (2) the reaches from the main channel to the Columbus Street Terminal, (3) Wando River, and (4) Shipyard River.

**3.6.1 Without-Project Condition.** The without-project condition assumes no change to the existing Federal navigation project, which would remain at 40 feet for the inner harbor channel, 42 feet for the entrance channel and 38 feet in Shipyard River. The channel in the Daniel Island Reach is considered to be widened at the existing project depth along the east bank to ensure navigational safety as shown in Figure 18. Operation of the new Daniel Island Terminal will not depend on channel deepening. The without-project condition is used to evaluate the benefits which would result from other alternatives. The existing or without-project condition was used as the base condition in the comprehensive modeling studies by the Corps' Waterways Experiment Station (WES).

**3.6.2 Channel Modifications.** Modification to channel width, alignment or structural alterations were considered in the evaluation of reaches where two-way traffic is necessary to accommodate the increase in traffic levels and vessel sizes. The current practice by harbor pilots is to meet and pass large vessels from the entrance channel to the upper end of Rebellion Reach in the lower harbor. Meeting and passing large vessels is avoided from Folly Reach thru Drum Island Reach due to short reach lengths and frequent bends in the channel. Two other obstacles inhibit safe navigation within this region: the Cooper River Bridges and the frequent shoaling of Drum Island Reach. Daniel Island Reach and Clouter Creek Reach are the only reaches in the 7.18 miles of the upper harbor which are suitable for meeting and passing large vessels. No passing is performed between two large vessels in the Wando River or Shipyard River. The channel modification alternatives are all considered in conjunction with the various channel depths (Section 3.6.3).

**Shutes/Folly Realignment.** The lower portion of the inner harbor provides the optimum location for meeting and passing of large vessels. The combined length of Shutes and Folly Reaches is 0.96 miles. The current alignment of these reaches prevents two-way traffic. The Cooper River above Horse Reach is a difficult passage for navigating large vessels and is not conducive to two-way traffic. Additional channel lengths suited for meeting and passing large vessels will reduce the delay time at terminals for vessels waiting on others to maneuver through the meandering channel. The elimination of bends in the Shutes, Folly, and Horse Reaches, will provide for two-way traffic on an additional 1.5 miles of the main channel. Figure 15 shows the existing and alternative alignment of these reaches.

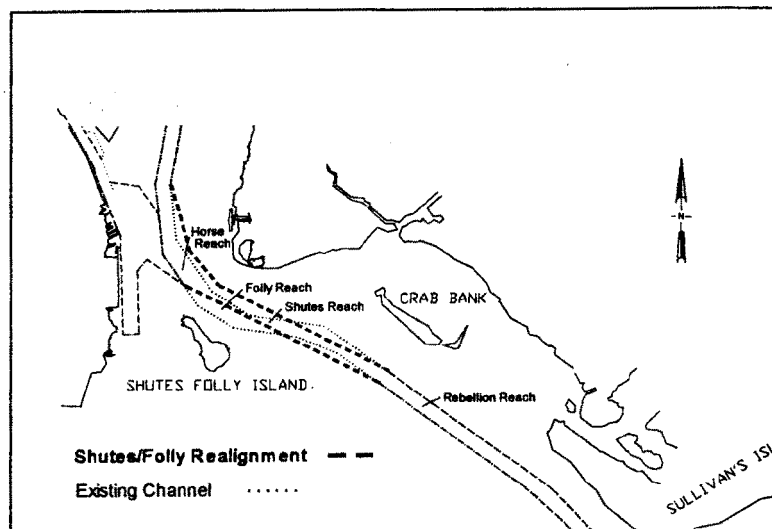


Figure 15: Alignment from Mt. Pleasant Range to Horse Reach

**Wando River.** The Wando River Reach is currently 400 feet wide and is unsuitable for two-way traffic. Delays are incurred at the Wando Terminal by vessels waiting

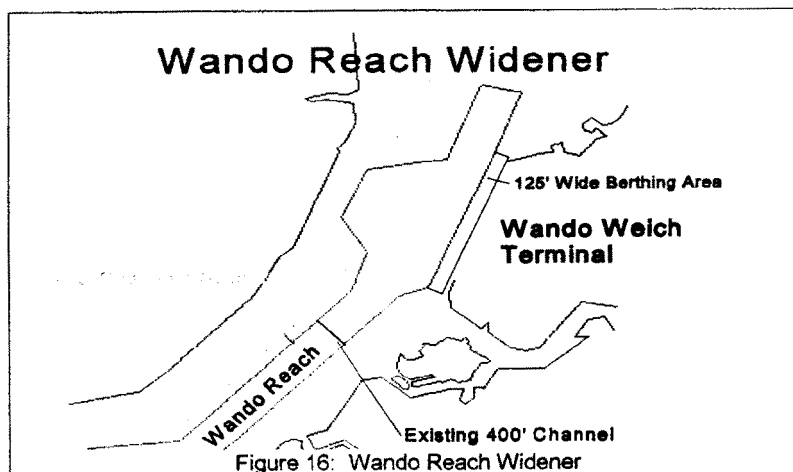
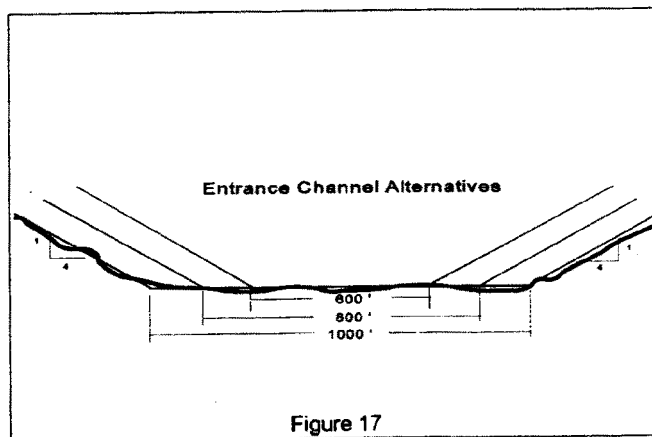


Figure 16: Wando Reach Widener

on inbound vessels navigating that reach. Widening this reach would provide 2.08 miles of additional two-way traffic. Figure 16 shows the existing Wando Channel along with the proposed 200-foot channel widener.

**Entrance Channel.** An initial investigation was conducted during the preliminary testing phase of the ship simulation study at the Waterways Experiment Station (WES). Tests were run to determine the suitability of the existing channel dimensions of the entrance channel. From these results, additional entrance channel widths (600 and 800-foot wide channels) were suggested for further investigation during the principal testing phase. Figure 17 shows the various channel widths which were evaluated during the ship simulation test runs.



**Daniel Island Reach.** The proposed Daniel Island Container Terminal will require a 7000-foot long berthing area. A 1400X1400-foot turning basin located across the Cooper River from the terminal will be included in the alternative plan. Figure 18 shows the existing channel and proposed improvements.

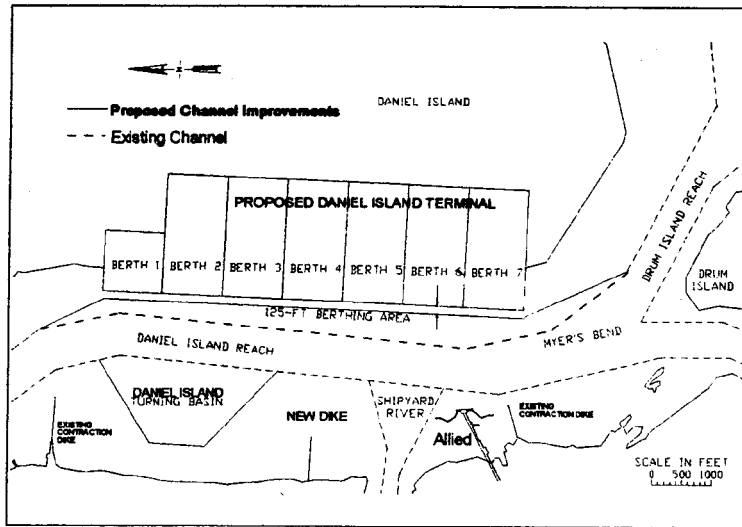


Figure 18: Daniel Island Terminal location and associated channel improvements

**3.6.3 Channel Deepening.** All deepening alternatives would require dredged material disposal site investigations pursuant to the plan selection. See Figure 19.

**Alternative 1.** This alternative would increase the authorized entrance channel depth to 43 feet approximately 14.7 miles from station 0+00 to the 43-foot ocean contour and increase the authorized project depth to 41 feet throughout the remaining project limits.

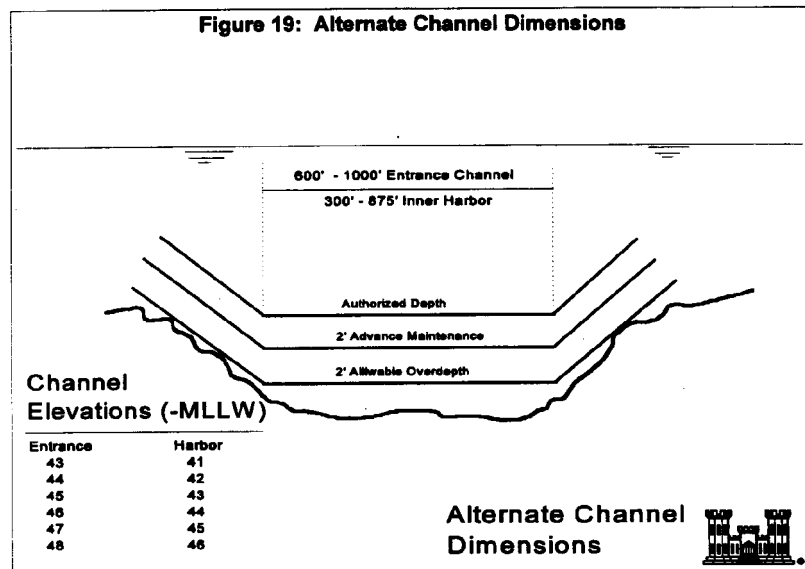
**Alternative 2.** This alternative would increase the authorized entrance channel depth to 44 feet approximately 14.8 miles from station 0+00 to the 44-foot ocean contour and increase the authorized project depth to 42 feet throughout the remaining project limits.

**Alternative 3.** This alternative would increase the authorized entrance channel depth to 45 feet approximately 15.2 miles from station 0+00 to the 45-foot ocean contour and increase the authorized project depth to 43 feet throughout the remaining project limits.

**Alternative 4.** This alternative would increase the authorized entrance channel depth to 46 feet approximately 16.1 miles from station 0+00 to the 46-foot

ocean contour and increase the authorized project depth to 44 feet throughout the remaining project limits.

**Alternative 5.** This alternative would increase the authorized entrance channel depth to 47 feet approximately 16.3 miles from station 0+00 to the 47-foot ocean contour and increase the authorized project depth to 45 feet throughout the remaining project limits.



**Alternative 6.** This alternative would increase the authorized entrance channel depth to 48 feet approximately 16.4 miles from station 0+00 to the 48-foot ocean contour and increase the authorized project depth to 46 feet throughout the remaining project limits.

**3.6.4 Non-Structural Alternatives.** Nonstructural alternatives to channel deepening include light-loading vessels, making optimal use of tidal delay, and optimizing the fleet used to transport cargo. The maximum practical implementation of these practices is assumed in the without project condition. For that reason, a separate nonstructural alternative was not evaluated.



### **3.7 Beneficial Use of Dredged Material**

Opportunities for beneficial use of dredged material were examined. Several ideas were identified and they are discussed below.

**3.7.1 Shore/Erosion Protection.** Material removed from the entrance channel was considered for placement along the beaches of Morris Island or Folly Island or offshore of the islands as both are located to the south of the entrance channel and have eroded extensively since construction of the jetties in the late 1890's. This alternative was not pursued further because of increased cost associated with placing the material on the beach and unsuitability of the material for such disposal. Material placed on a beach for erosion protection is desired to be of coarser grain size than the natural material to prevent rapid erosion. The maintenance dredged material is fine grained sand and easily erodible by wave action. Material considered for offshore placement was to serve as a wave-breaker to the barrier islands. Placement of the dredged material near enough to shore to serve as a wave-breaker is not feasible due to the shallowness of the offshore waters and inability to get close enough to the shoreline to have any effect on the offshore wave action.

**3.7.2 Nesting Habitat at Crab Bank.** This plan provided for dredged material from the realigned area of Shutes/Folly Reaches to create a more suitable environment for nesting of a multitude of shorebirds on Crab Bank Shoal located between Shem Creek and Rebellion Reach. This plan received enthusiastic support from environmental agencies. The most desirable material for this plan is coarse clean sand or gravel which can be used for nesting habitat. However, the resource agencies also expressed an interest in having less desirable materials utilized as a base overlaid with a cap of the appropriate nesting material. The material to be removed from the channel reaches adjacent to Crab Bank would normally be taken to the ODMDS for disposal by means of an ocean-going scow after being removed by a clam shell dredge. This option appears to be feasible and may be further evaluated during Planning Engineering and Design.

**3.7.3 Castle Pinckney.** Castle Pinckney is located on Shutes Folly Island within the harbor. This small island has experienced erosion problems around the south-east side of the island that could threaten the culturally significant historical site. Placement of dredged material from the adjacent realigned Shutes/Folly Reaches was considered as both a protective action for the castle as well as creating a nesting area for shore birds. The potential disposal capacity of the island was considered insignificant as an alternate upland dredged material disposal site for this project. However, the State Ports Authority has requested the Corps of Engineers to investigate protection of Castle Pinckney shoreline under the Continuing Authorities Program.

**3.7.4 ODMDS.** Dredged material designated for disposal in the ODMDS consists of rock, marl and coquina. This material will serve as a reef in the immediate area of placement for a live bottom environment. The live bottom area to the west of the designated offshore site will be further protected by the additional material placed from this project.

## **4. Comparison of Alternative Plans**

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### **4.1 Design Considerations**

Each alternative plan was evaluated for economic benefits, environmental concerns, aesthetics, and satisfaction of navigational requirements. The investigated plans combined variable channel width or realignment designs with channel deepening designs as coordinating plans. No channel realignments were considered for construction at a channel depth different from the selected project depth.

**4.1.1 Design Vessels.** The design vessels selected for this study were determined to be the most economically representative of the projected fleet calling on the port. Based on the commerce passing through Charleston Harbor, a container ship and a bulk carrier were selected as design vessels. Dimensions of the selected design vessels as shown in Table 4. These design vessels are suited for the most optimum plan for simulating meeting and passing in the harbor.

Table 4  
Ship Simulation Test Design Vessels

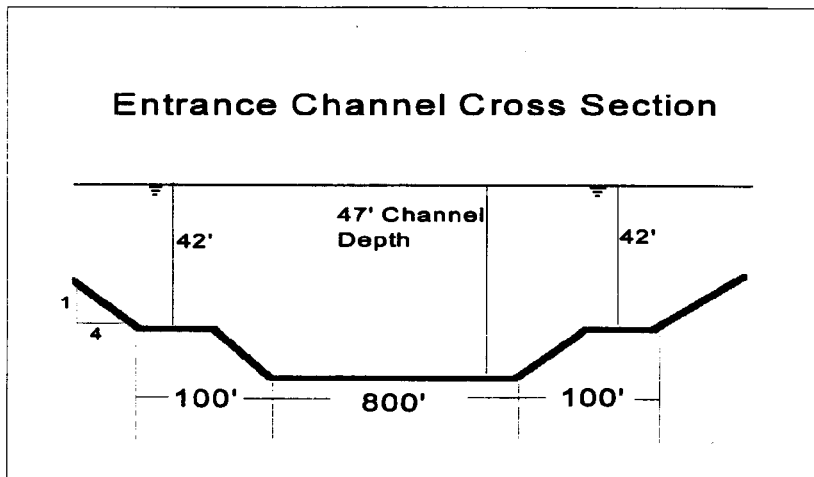
Test Design Vessels			
Ship Type	LOA ft	Beam ft	Draft ft
Container Ship	950	130	45
Bulk Carrier	875	144	45

**4.1.2 Channel Design.** Increases in vessel length, beam and draft combined with more vessel traffic creates the need for channel improvements in Charleston Harbor. The present port facilities have experienced a substantial increase in business in the past 15 years. The vessels calling on the harbor are much larger than in the past; container vessels exceeding 950 feet in length and with design drafts of 41 to 44 feet make up a significant share of Charleston's fleet. With the exception of the Wando Reach widener, all the alternative channel designs listed in Sections 3.6.2 and 3.6.3 were tested in the ship simulation model at WES. Widening the Wando Reach was not anticipated to be justified at the time of the ship simulation phase of the study. The 200-foot channel widener was investigated in the economic analysis for two-way traffic as dictated by comparable reaches in the harbor.

**Channel Depth.** Deep draft vessels currently calling on the port are required to either light load and/or utilize the tidal cycle to transit the navigation channel by maintaining a safe underkeel clearance distance of four feet. Economic costs and benefits were evaluated for channel depths in one-foot increments from 41 feet to 46 feet to determine the most beneficial design channel depth.

**Entrance Channel.** With deepening of the channel, the limits of the entrance channel will be extended to the depth of the natural ocean contour. The depth of the entrance channel will continue to be two feet deeper than the design channel depth of the inner harbor channel to allow for wave action experienced in the open waters of the ocean. During the pre-testing phase of the ship simulation study on the entrance channel, results indicated alternate channel widths warranted testing in the simulator. The existing 1000-foot channel width, an 800-foot channel width and a 600-foot channel width were tested. Figure 20 illustrates the final design for the entrance channel resulting from consensus during the Technical Review Conference. The entrance channel will be deepened to 47 feet with a width of 800 feet. The channel will be centered in the existing 1000-foot channel with the remaining 200 feet to continue to be maintained at 42 feet.

**Figure 20**  
**Entrance Channel Design**



**Inner Harbor Channel Improvements.** Three channel areas of the inner harbor were considered for channel widening or realignments. The bend at the Shutes, Folly and Horse reaches was investigated for realignment to extend the length of channel for two-way traffic of large vessels. This reach is the last area of the harbor in which meeting and passing of large vessels is considered. Upriver of this area lies the Highway 17 bridges, Drum Island Bend, and a series of short transits that are navigational hazards which discourage two-way traffic.

Channel widening was considered in two other reaches of the inner harbor - the Wando and Daniel Island Reaches. The width of the Wando (400 feet) is insufficient for two-way traffic. Delays are experienced by vessels at the Wando Terminal waiting for vessels to navigate the Wando channel.

The Daniel Island Reach was investigated for widening primarily to facilitate the needs of the new container terminal along the Cooper River on Daniel Island. Various channel alignments were considered for optimum use of the new port facility and navigation considerations. The SCSPA and the Corps worked together to design the layout of the terminal in relationship with the channel and current flow patterns. The terminal will generate a dramatic increase in vessel congestion within the reach as a turning basin and seven-berth terminal is introduced. Two-way channel traffic combined with docked vessels at the new Terminal and Allied Pier, and turning vessels in the basin add to the complexity of a reach located immediately up river of a difficult navigational bend and two protruding 700-foot long training dikes (Figure 18, Section 3.6.2).

All navigation features of Charleston Harbor were evaluated in order to determine the benefits derived from channel deepening. Shem Creek and the Ashley River do not have deep-draft vessel traffic and therefore were not considered for improvements from this project. The vessels which use the pier at Tidewater Reach are typically cruise ships that have drafts less than 40 feet and would therefore not need additional channel depths and would not contribute to the economic benefits of this project. Upper Town Creek and the portion of Lower Town Creek above Columbus Street Terminal (including the Town Creek turning basin) do not require any additional channel depth since the Town Creek channels are no longer required for passage of large vessels. These areas of the existing authorized Federal navigation channel were not considered for deepening or channel improvements in this study.

**4.1.3 Dredging Quantities.** Design alternatives will extend the existing navigation channel from 40 feet deep to 46 feet deep at one-foot increments. In addition to deepening the existing channel alignment, the areas of channel realignment and dredging of Daniel Island Turning Basin will be taken to the selected design channel depth. Quantities for each depth alternative are listed in

Table 5. Deepening will include two feet of advance maintenance and two feet of allowable overdepth. All channel reaches will adopt the existing channel side slope of one vertical on four horizontal. Quantity amounts were derived from condition bathymetric surveys conducted after dredging for the existing authorized project. The quantities derived in Table 5 were calculated by deducting the existing maintenance quantity from the deepening prism.

Table 5  
Dredging Quantities  
(Cubic Yards)

REACH	PROJECT CHANNEL DEPTH (Feet Below MLLW)							
	41	42	43	44	45	46		
Entrance Channel	4,927,615	7,163,234	9,207,002	11,338,574	13,541,781	15,378,561		
Mt. Pleasant Range	28,850	55,781	81,508	108,353	135,589	162,825		
Hog Island	224,539	407,963	599,754	797,185	1,000,377	1,208,422		
Drum Island Bend	18,221	29,792	45,771	64,004	84,262	108,208		
Drum Island	127,499	238,569	362,704	491,429	623,031	757,001		
Custom House	30,873	64,607	106,866	152,316	198,175	245,680		
Tidewater	37,139	71,537	111,785	153,832	196,152	239,228		
Lower Town Creek	126,256	204,421	289,174	378,071	464,070	553,138		
Turning Basin	45,471	95,941	156,574	221,100	287,561	355,355		
Shipyards River	122,377	186,033	261,422	341,491	424,335	509,312		
Daniel Island	160,577	269,394	381,487	496,358	614,031	734,730		
Daniel Island Bend	140,882	230,996	327,840	429,625	534,515	641,332		
Clouter Creek	200,992	361,311	528,936	700,996	877,361	1,057,801		
Navy Yard Upper	141,993	230,385	322,736	417,573	514,573	613,793		
Navy Yard Lower	40,273	80,447	131,034	188,490	249,696	313,969		

**Table 5**  
**Dredging Quantities, Cont.**  
**(Cubic Yards)**

REACH	PROJECT CHANNEL DEPTH (Feet Below MLLW)					
	41	42	43	44	45	46
North Charleston	162,381	278,109	398,317	524,448	656,204	783,542
Filbin Creek	147,365	239,440	335,017	433,836	534,223	636,374
Port Terminal	97,356	175,727	257,482	341,321	427,733	515,459
Ordinance	80,846	161,001	244,931	329,810	415,606	502,350
Ordinance Turning Basin	44,996	74,962	106,441	139,562	174,240	210,113
Wando	80,601	212,881	373,516	545,826	727,219	915,091
Wando Terminal/Turn. Basin	129,051	266,296	447,372	635,771	827,036	1,020,172
Custom House Berth	125,930	140,740	155,560	170,370	185,190	200,000
North Charleston Berth	163,200	179,410	209,970	240,525	271,070	301,625
Allied Pier	27,780	33,340	38,890	44,450	50,000	55,560
Hess Pier	80,560	97,710	114,830	131,970	149,090	166,220
Shipyard Berth	7,640	10,191	12,740	17,600	22,460	27,320
Wando Berth	34,260	51,530	68,520	85,650	102,780	119,910

**Table 5**  
**Dredging Quantities, Cont.**  
**(Cubic Yards)**

REACH	PROJECT CHANNEL DEPTH (Feet Below MLLW)					
	41	42	43	44	45	46
NEW WORK QUANTITIES						
New Reballton	1,108,800	1,144,100	1,181,600	1,219,100	1,256,700	1,554,500
New Horse/Shutes	2,525,940	2,634,430	2,742,905	2,851,375	2,960,010	3,080,218
Daniel Island Turning Basin	2,940,000	3,070,000	3,200,000	3,330,000	3,450,000	3,540,000
Daniel Island Widening	3,800,000	4,000,000	4,200,000	4,300,000	4,500,000	4,600,000
Daniel Island Berth	1,290,000	1,330,000	1,360,000	1,390,000	1,420,000	1,450,000
TOTAL	19,215,863	23,792,288	26,382,694	33,008,412	37,875,270	42,545,779

Quantities were calculated from the post-deepening surveys of the existing authorized navigation project.  
Figures reflect 2 feet advance maintenance and 2 feet allowable overdepth.

**4.1.4 Increased Annual Maintenance.** An increase in annual dredging maintenance is expected due to each design alternative based on the sedimentation study conducted by WES. The sedimentation investigation was based on historical dredging quantities both before and after previous channel deepening projects and maintenance practices. The numerical model STUDH, part of the TABS-MD package was used to predict shoaling tendencies for a channel depth of 45 feet. The realignment at Shutes/Folly Reach and the alternate channel design plans for the Daniel Island Reach were tested in the model to investigate impacts to shoaling within the project. The existing project conditions were tested to determine a base condition used for comparison of the alternate plans. The channel realignments were then modeled at the 45-foot channel depth to determine changes resulting from the alternate plans. An overall increase of shoaling of 60% was estimated throughout the project limits. The most dramatic increase was experienced in the Daniel Island Reach where nearly 740% increase was calculated. This is due to the increase in channel area by nearly two times the existing area. This increase was considered too excessive for maintenance purposes and an alternative was sought. An additional alternate design plan was developed by WES to reduce the amount of predicted shoaling in this reach by including a contraction dike along the west side of the channel located to the north of Shipyard River and the Navy's Degaussing Pier. This plan reduced the estimated shoaling in this reach by nearly 200,000 cubic yards annually. The estimated increase in shoaling quantities listed in Table 6 reflect the implementation of the new contraction dike in conjunction with the two restored existing dikes (existing dike on Daniel Island will be removed to allow for channel widening).

**Table 6**  
**Estimated Increased Annual**  
**Maintenance**  
**(Cubic Yards)**

Channel	41	42	43	44	45	46
Entrance	16,000	32,000	48,000	64,000	80,000	96,000
Harbor	272,000	344,000	419,000	495,000	573,000	652,000

**4.1.5 Associated Improvements.** Improvements associated with the deepening project are primarily those involving deepening of the adjacent berthing areas consistent with the deepening alternative. Construction of the Daniel Island Turning Basin and berthing area will be dependant upon completion of the first phase of the new Daniel Island Terminal which is expected to occur in 2003.



## **4.2 Project Costs**

**4.2.1 Construction Cost Estimates.** The initial cost estimate was based on quantities provided from the surveys taken of the harbor after the last deepening of the channel to the present authorized Federal project depth of 40 feet. Extensive geotechnical investigations of the harbor including subbottom profiling and vibracore borings were analyzed to determine the extent and means of recommended removal of material. The entrance channel estimates were determined assuming the use of a hopper dredge with 4000 cubic yard scows to transport the material to the ODMDS. In reaches of the inner harbor where material was calculated for offshore placement, clam shell dredges were figured in the estimate with 4000 cubic yard scows transporting the material to the ODMDS. In reaches where material was placed in various upland disposal sites it was assumed the work would be accomplished by an 18" hydraulic dredge. Estimates were determined for reaches with alternate disposal sites to determine the most cost effective dredged material disposal plan. The cost estimates reflect higher cost per total cubic yard for the shallower channel designs. This is reflected because of more efficient dredging practices for deeper material removal. Reaches scheduled for material to be removed by clamshell dredging is an example of this phenomenon. Clamshell dredges are utilized in areas in which dredged material is to be taken offshore for disposal. Dredges of this type utilize a bucket mechanism which digs the material from the channel in large amounts by lowering the open bucket to the bottom of the channel. The amount of material collected is determined by the weight of the bucket and the hardness of the material. The dredge operator attempts to get the maximum amount of material on each deployment of the bucket for peak efficiency. Therefore, the more efficient operating practice for the clamshell dredge is to dredge material in deep increments rather than skimming thin layers of material from the channel as a hopper dredge would.

**4.2.2 Project Investment Costs.** The total project cost includes the construction cost, Planning Engineering and Design (PED), Real Estate, Interest During Construction, and Construction Management. The construction time varies for each design depth. For the 41 and 42-foot project depth the estimated construction period is three years. A four-year construction period is required for channel depths of 43 to 45 feet and the 46-foot project requires a five-year construction period. Construction time is determined by the ability to pump into upland sites, dewater the material, raise the dikes, and repeat the process.

**4.2.3 Maintenance Costs.** The cost associated with additional maintenance dredging was calculated based on projected increases in shoaling estimates for each project design depth to an equivalent annual cost over 50 years. Maintenance costs for the inner harbor was calculated based upon current practice of upland

disposal for material taken from the inner harbor. Material from the entrance channel will be taken to the ODMDS.

**4.2.4 Annual Costs.** The total estimated investment costs (total project cost plus interest during construction), were amortized over a project life of 50 years at the current Federal discount rate of 7.625% for each alternative. To this cost was added the increased maintenance cost for total annual costs as shown in Table 5 or expressed in 1995 price levels.

#### **4.3 Comparative Environmental Effects**

The comparative environmental effects have slight differences between the channel deepening alternatives. The major difference between these plans is the amount of material to be removed from the channel. Since the dredged material disposal sites remain constant throughout the deepening plans, there is no differential environmental impact from these plans.

The alternative channel realignment and widening plans would also have an impact on the amount of material removed from the harbor. This material has been tested and is being analyzed to determine suitability for offshore placement in the ODMDS or upland dredged material disposal sites. The new work areas encountered from the realignment and widening will temporarily impact those organisms dwelling in the immediate area of the project. Environmental impacts associated with dredging are discussed in the 404(b)(1) and the Environmental Assessment of this report.

#### **4.4 Benefit Analysis**

The economic feasibility of a deep draft navigation project is determined by comparing the benefits and costs associated with the project alternatives. National Economic Development (NED) benefits are the contribution of a project to the national output of goods and services. Typically, these benefits are the result of reduced transportation costs. NED costs are the economic value of the resources consumed in the construction, operation, and maintenance of the project. Any project alternative with positive net NED benefits is economically justified. The optimal plan is that which maximizes net NED benefits.

The benefits of turning basins and additional two-way traffic areas were measured in terms of reductions of delays and intra-harbor transit times associated with the construction of these features. The dollar value of these benefits was determined by applying estimates of vessel operating costs to time savings. Since the gangs used to unload vessels will already be scheduled before incoming vessels know that a channel is not available for transit, labor costs avoided were also considered in the evaluation of benefits for two-way traffic areas (inbound traffic only).

The benefits from deepening Charleston Harbor are measured as reductions in the future cost of transporting bulk commodities and containerized cargo. Transportation savings under with-project conditions result from the use of larger, more efficient vessels and the more efficient use of large vessels that already call on the harbor. These savings are measured by subtracting the cost of shipping commodities under with-project conditions from the cost under without-project conditions.

Per-ton transportation costs were computed for all vessel sizes, light loading conditions, and tidal requirements. A weighted average of these costs was computed using the projected fleet distributions.

Transportation savings per ton of cargo were computed by comparing the per-ton weighted average transportation costs under with and without-project conditions. These per-ton savings were applied to projected traffic levels to compute total savings by commodity group.

The benefits accruing to each project alternative were computed in this manner for each year from 2002 to 2052. Construction periods varied from three years for the 41 and 42-foot channels to 4 years for the 43 to 45-foot channels and 5 years for the 46-foot channel. A 50-year benefit stream was computed for each project alternative beginning with the first year that the project is fully operational. The present value of these streams of benefits and the equivalent average annual benefit were computed using the current Federal discount rate of 7.625 percent and a base year of 2002.

#### **4.5 Benefit-to-Cost Evaluation**

**4.5.1 Determination of Optimal Project Depth.** All channel deepening components were considered together in the determination of optimal project depth. However, since the Shipyard River reach is used almost exclusively by Charleston Harbor's only coal terminal, the optimal depth of this reach was evaluated independently after the optimal depth of the main channel was determined. The incremental justification of all other separable components of the channel deepening project was also investigated. The determination of the optimal depth of the total deepening project is described in this section; incremental analyses are described in Section 4.5.2.

The costs and benefits associated with the complete harbor deepening project are shown in Table 7. This includes the costs and benefits associated with deepening the main channel and all secondary channels to the specified depths. The total investment cost of each alternative is the sum of direct construction costs,

**Table 7**  
**Net Benefit Evaluation**  
**Complete Harbor Deepening Project**  
**(Thousands of 1995 Dollars)**

Project Draft in Feet						
Item	41	42	43	44	45	46
<b>Costs</b>						
<u>General Navigation Features</u>						
Contraction Dikes	3,569	3,569	3,569	3,569	3,569	3,569
Channel Deepening	34,093	44,918	51,798	58,598	65,407	73,916
Mitigation	20	20	20	20	20	20
Subtotal	37,682	48,507	55,387	63,185	68,996	77,505
Contingencies	5,852	7,276	8,308	9,478	10,349	11,626
Construction Management	1,800	1,800	2,000	2,000	2,000	2,400
PED	2,620	2,620	2,620	2,620	2,620	2,620
Monitoring ODMS	500	500	500	500	500	500
Total	48,055	60,503	68,815	77,783	84,466	94,850
<u>Aids to Navigation</u>	78	78	78	78	78	78
<u>Non-Federal Costs</u>						
Real Estate	15	15	15	15	15	15
Berthing Areas	4,290	4,505	4,679	4,698	5,229	5,405
Disposal Diking	583	939	1,322	1,720	2,130	2,549
Subtotal	4,888	5,459	6,016	6,433	7,373	7,968
Contingencies	733	819	902	985	1,106	1,195
Total Non-Federal Costs	5,621	6,278	6,919	7,397	8,479	9,164
Total First Costs	53,754	66,859	75,812	85,258	93,023	103,892
IDC	9,844	12,601	13,578	15,402	16,704	18,060
Total Investment Cost	63,598	79,459	89,390	100,661	109,727	121,952
<u>Average Annual Costs</u>						
Interest	4,849	6,059	6,816	7,675	8,367	9,299
Amortization	126	158	177	200	218	242
Annual O & M	145	341	538	734	930	1,227
Total AAC	5,121	6,557	7,531	8,609	9,515	10,768
<u>Average Annual Benefits</u>						
Total AAB	8,183	10,840	13,901	16,404	17,856	18,757
B/C Ratio	1.60	1.65	1.65	1.91	1.88	1.74
Net Benefits	3,062	4,282	6,369	7,795	8,342	7,989

Source: Computations by the Charleston District; reflects 1995 dollars and the current federal discount rate of 7.625 percent.

administrative and design costs, real estate costs and interest that accrues from expenditures made prior to the base year. Direct construction costs include the cost of dredging and disposal of dredged material (shown together in Table 7), the cost of constructing and improving dikes at disposal sites, and the cost of mobilizing and demobilizing construction operations. Real estate, PED, and construction management costs are added to construction costs to determine total first costs. Computations of interest during construction reflect the varying construction schedules; interest during construction is added to first costs to determine total investment costs.

The present value of total investment costs is converted to an equivalent average annual cost for comparison with average annual benefits. First, total investment costs are adjusted to reflect the discounting of construction costs incurred after the base year. This yields the present value of the total investment. Average annual costs are determined by adding annual O&M charges to the interest and amortization of the present value of the total investment.

The present value of benefits includes both the discounted value of the 50-year stream of benefits and the present value of benefits that accrue during the construction of the project. All costs and benefits are expressed in 1995 dollars and all interest and discounting computations reflect the current federal discount rate of 7.625 percent and a base year of 2002.

Net NED benefits are maximized by deepening the harbor to 45 feet. The optimal project depth was determined by comparing total project costs and benefits as shown in Table 7. All benefits and costs for all components involving channel deepening were included in the determination of optimal project depth.

**4.5.2 Incremental Analysis.** Separate evaluations of benefits and costs were conducted for the main channel on the Cooper River and for each separable increment of construction, including deepening the Custom House reach to the Columbus Street Terminal; deepening the existing Wando River channel to the Wando Terminal; and deepening the Shipyard River channel. The optimal channel depth of 45 feet is economically justified for the main channel and for each separable increment of the total deepening project.

All of Charleston's coal traffic originates from the Shipyard River. Coal benefits account for the vast majority of benefits attributable to deepening Shipyard River. For this reason, the deepening of Shipyard River was evaluated at one-foot increments from 41 to 45 feet. A 46-foot channel was not evaluated since the optimal depth of the main channel was determined to be 45 feet.

Once the optimal project depth was determined, incremental evaluations were conducted for plans to realign the channel in the Shutes/Folly reaches to allow two-way traffic; plans to widen the Wando River channel to allow two-way traffic; and plans to construct a turning basin for vessels that will use the new Daniel Island Terminal. Table 8 lists the net benefits evaluation for the Daniel Island Turning Basin and the realignment for Shutes/Folly Reaches.

Providing two-way traffic on the Wando River was found to be infeasible by a wide margin. The delays associated with one-way traffic on the Wando are minor and infrequent. Benefits and costs for this project component are not shown.

With the construction of a 45-foot channel, the optimal depth of the new Daniel Island turning basin is also 45 feet. Without this turning basin, all ships using the Daniel Island Terminal must continue 6.0 miles past the terminal to the Ordinance Reach turning basin in order to turn and then travel 6.0 miles back to the Daniel Island Terminal.

The channel realignment in the Shutes/Folly reaches was found to be economically justified. When large ships transit the Shutes/Folly reaches of the Harbor, no other ships can safely pass that vessel. Outbound vessels must delay their departure from the terminal for an inbound vessel to clear the Shutes/Folly Reaches. Associated vessel delays can be as long as 2 hours and average delays are approximately 1 hour. Benefits associated with the Shutes/Folly realignment are derived from the elimination of these delays; delays associated with one-way traffic in other reaches of the harbor are not affected. Average delays are reduced by about 15 minutes with the realigned channel. The realigned channel is about 0.4 miles shorter than the original alignment. The reduced intra-harbor transit time associated with the realigned channel are another source of benefits.

**Table 8**  
**Charleston Harbor Study**  
**Net Benefits Evaluation**  
**Total Harbor Project**  
**(Thousands of 1995 Dollars)**

Item	Channel Deepening	Daniel Island Turning Basin	Shutes/Folly Realignment	Total Project
<b>Summary of First Costs</b>				
General Navigation Features	84,466	8,604	4,702	97,772
Other Federal Costs	78			78
Non-Federal Costs	8,479			8,479
Total First Costs	93,023	8,604	4,702	106,330
IDC	16,704	(423)	1,263	17,544
Total Investment Cost	109,727	8,181	5,965	123,873
<b>Average Annual Costs</b>				
Interest	8,367	624	455	9,445
Amortization	218	16	12	246
Annual O&M	930	70	10	1,010
Total Average Annual Costs	9,515	710	477	10,701
<b>Average Annual Benefits</b>				
Total AAB	17,856	832	823	19,511
B/C Ratio	1.88	1.17	1.73	1.82
Net Benefits	8,342	122	346	8,810

**4.5.3 NED Plan.** Each channel depth plan yielded positive benefit/cost ratios. The plan which yielded the greatest net benefits was the 45-foot channel design. The NED plan is normally the preferred alternative selected for Federal implementation as it maximizes the benefits to the nation and the return on the investment.

The NED plan analysis was computed using 1995 price levels and the current Federal discount rate of 7.625 percent.

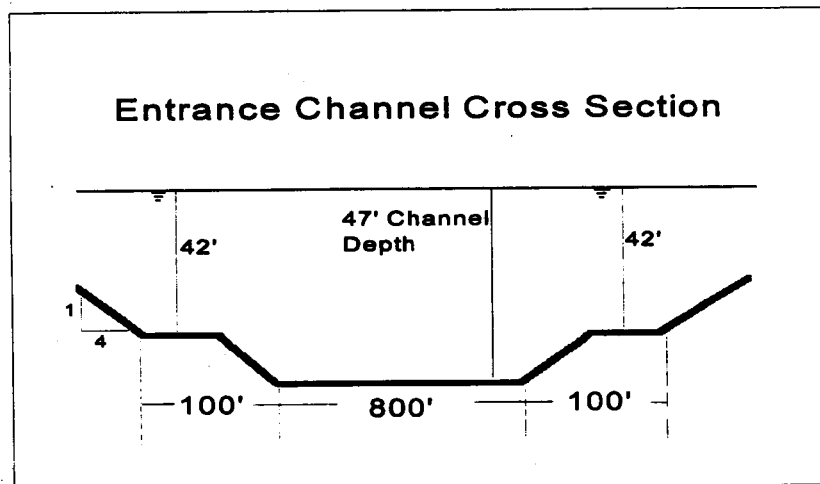
## 5. Selected Plan

### 5.1 Plan Components

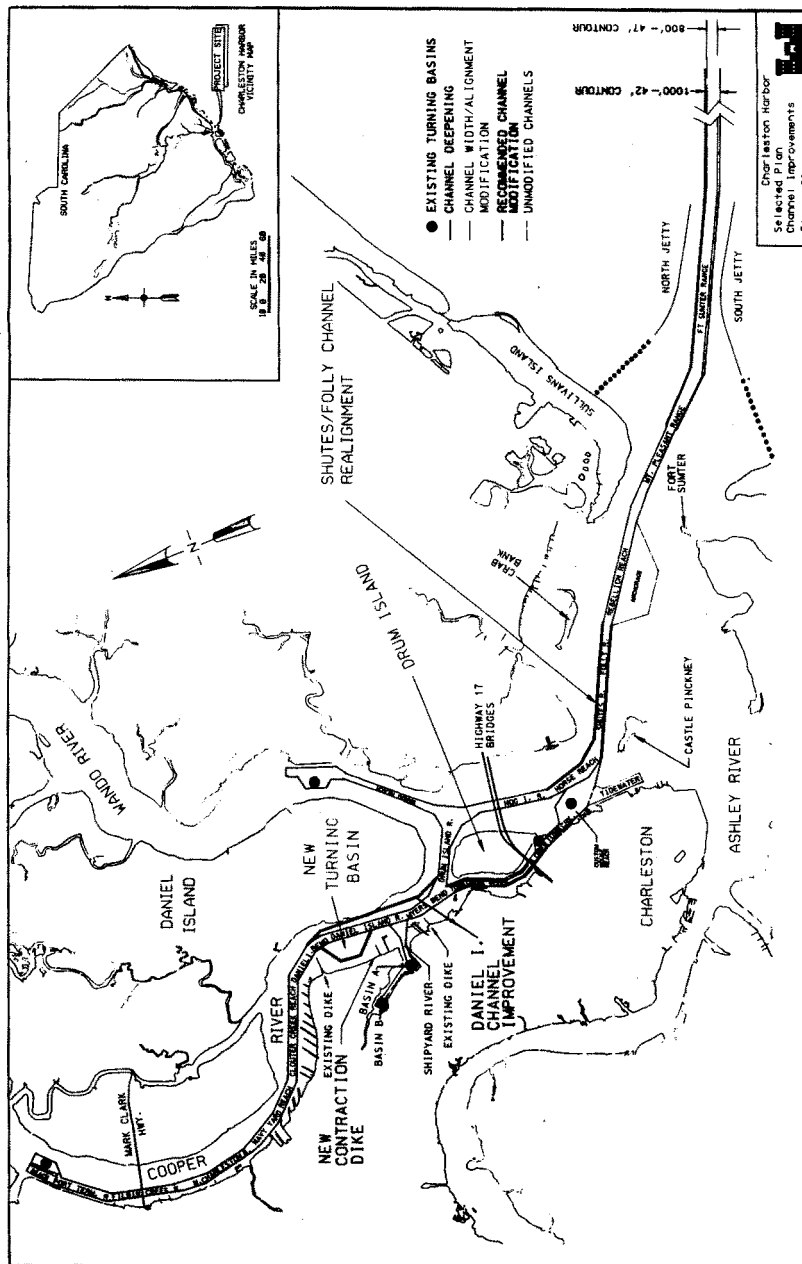
**5.1.1 Description and Justification.** The selected plan, as well as the NED plan, was determined to be a 5-foot channel deepening to 45 feet below MLLW. The entrance channel will be at a depth of 47 feet below MLLW and extend oceanward to the 47-foot contour. Approximately 33,326,000 cubic yards of material will be excavated.

**Entrance Channel.** The depth of the entrance channel is required to be an additional 2-feet deeper than the project depth to account for pitch, roll and heave effects due to wave conditions experienced in open waters. The entrance channel will be deepened to 47 feet below MLLW by 800 feet wide. The entrance channel will extend from the 47-foot ocean contour to approximately station 0+00 between the Ft. Sumter and Mt. Pleasant Ranges where the channel has natural depths exceeding 60 feet. At this point the channel depth will transition to the 45-foot project depth. (See Figures 21 and 22)

**Figure 21**  
**Recommended Entrance Channel**



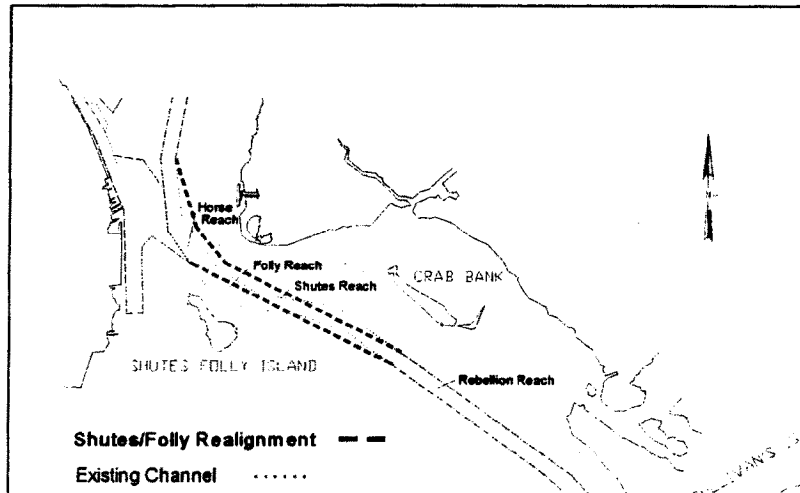




**Inner Harbor.** The inner harbor will be deepened to 45 feet below MLLW from station 0+00 to the North Charleston Terminal and turning basin. The Wando Reach and turning basin, Lower Town Creek, Custom House Reach, the turning basin at Columbus Street Terminal (Custom House Reach) and Union Pier, and Shipyard River Entrance Channel including Basin A are to be deepened to 45 feet.

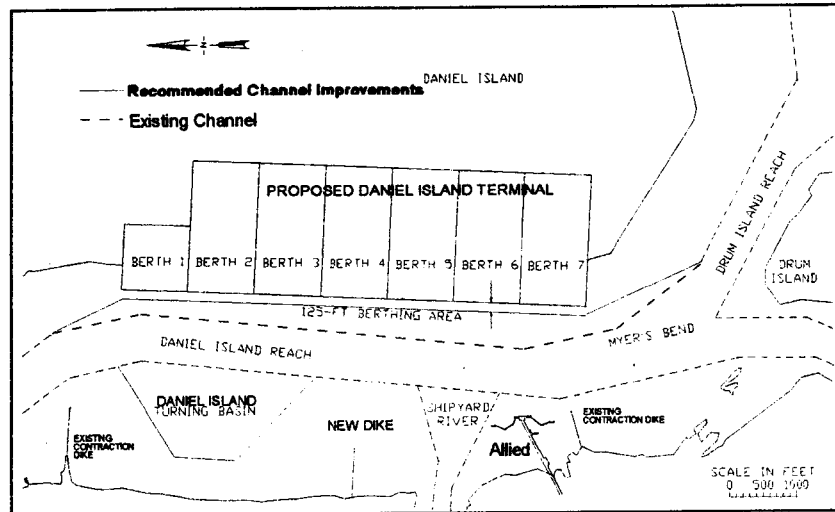
**Channel Realignment/Widening.** The Shutes and Folly Reaches located in the lower harbor, will be realigned to allow for extended reaches suitable for meeting and passing large vessels. The realignment will begin at Station 177+62 and end at Station 264+12 in Horse Reach. The channel width will remain at 600 feet. (See Figure 23)

**Figure 23**  
**Channel Realignment**



The Daniel Island Reach will be widened along the east side of the channel to provide safe navigation for the increase in large commercial vessel traffic and size. The widening will begin at Myers Bend where the width of the channel will be increased from 600 feet to 875 feet. This width will taper back to 600 feet at Daniel Island Bend approximately 7500 feet up river of Myers Bend. The berthing area, channel widening and turning basin will be conducted in coordination with the future Daniel Island Terminal. (See Figure 24)

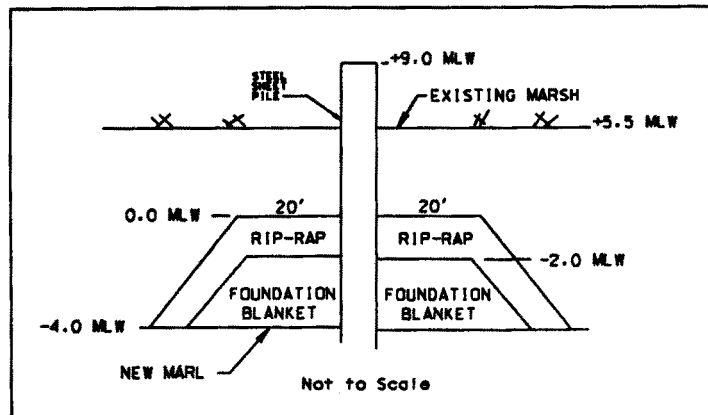
**Figure 24**  
**Recommended Channel Design**  
**for Daniel Island Reach**



**Turning Basins.** A new turning basin will be constructed opposite the future Daniel Island Terminal along the west side of the channel in Daniel Island reach. This turning basin will be approximately 1400 feet X 1400 feet at the proposed project depth. The existing turning basins at the Wando Terminal, North Charleston Terminal, Columbus Street Terminal, and Basin A in Shipyard River will be deepened to 45 feet at their existing dimensions. (See Figure 22)

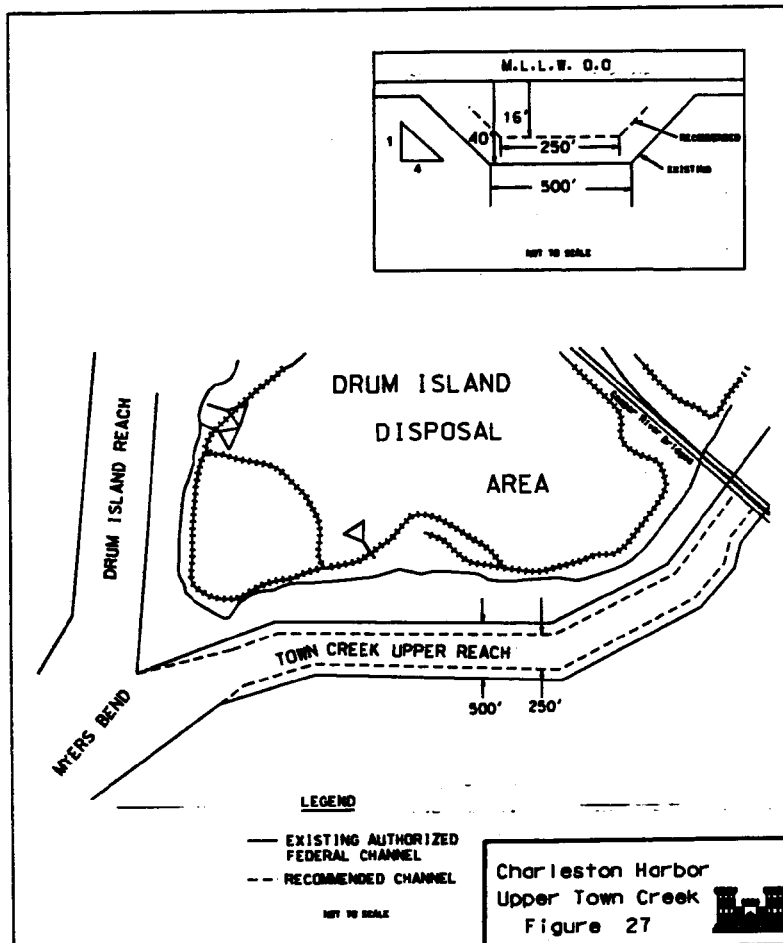
**Contraction Dikes.** The two existing contraction dikes located along the west side of Daniel Island reach will be restored to their original condition to assist in reducing the predicted shoaling of Daniel Island reach. Figure 25 depicts the existing contraction dike located at the Navy Shipyard. An additional contraction dike, approximately 700 feet long will be constructed within the 300 feet north of the Navy's Degaussing Pier on the same side of the channel as the Navy Shipyard. The restoration of the existing dikes along with the construction of the new dike is expected to reduce the shoaling in Daniel Island reach by fifty percent. Figure 26 illustrates a typical cross section view.

**Figure 25**  
**Existing Contraction Dike**



**Figure 26: Dike Cross Section**

**Channel Modifications.** The Upper Town Creek channel, from the Cooper River Bridges to Myers Bend, will be reduced to 250 feet wide by 16 feet deep. This channel was part of the main Federal channel prior to the existing Cooper River Channel. The need for the 500-foot wide channel at the project depth is no longer needed for the larger vessels. The channel continues to be used by tug operators and barges.



**Continued Maintenance.** No deepening or channel improvements are recommended for the Anchorage Basin, Shipyard River Connector Channel and Basin B, the Lower Town Creek turning basin, and lower Tidewater Reach. These reaches will continue to be maintained at their existing authorized depths.

**Advance Maintenance.** The currently authorized advance maintenance program will be continued as the method of practice for the recommended project. This program allows for advance maintenance of 2 feet in addition to 2 feet allowable overdepth. Similar shoaling patterns are expected to continue, therefore, necessitating the advance maintenance program.

**Berthing Areas.** The berthing areas at the Wando, North Charleston, Columbus Street, Union Pier, Allied Pier, Hess Pier, Shipyard Coal, Grain, and the future Daniel Island Terminal will be deepened to 45 feet below MLLW by the users. The berthing area associated with the new terminal will be 125 feet wide by 7000 feet long at the project depth. Berthing area widths will continue to be 125 feet from the edge of the Federal navigation channel to the wharf as shown in Figures 8 and 9. All structures will be distanced at least 125 feet from the edge of the Federal navigation channel.

**5.1.2 Costs.** The total project investment cost estimate of \$123,873,000 for the selected plan is listed in Table 8. In accordance with EC 1110-2-538, a baseline cost estimate to implement the project, if authorized for construction, has been developed to the mid-point of construction. Fully-funded costs and Federal/non-Federal cost sharing are discussed in Section 6, Plan Implementation.

Associated non-Federal costs consists of dredging and maintaining berthing areas (existing and proposed) adjacent to the channel and cost associated with dredged material disposal site preparation. No other work is anticipated at this time.

**5.1.3 Construction Methods.** The method of material removal most likely to be used in the entrance channel will be a combination of 30-inch hydraulic dredge and hopper dredge. The hydraulic dredge will remove the material from the channel then place it in 4000 cubic yard scows to transport the material to the ODMDS. The hopper dredge places the material in the hopper then transport the material to the ODMDS. A clamshell and scow operation will be used for the inner harbor reaches with material designated for placement in the ODMDS. The remaining portion of the harbor will be dredged with hydraulic dredges with material transported to upland disposal sites by pipelines.

The Coast Guard and National Oceanic and Atmospheric Administration (NOAA) will be notified of the channel dimension changes at the Upper Town Creek Reach for appropriate navigation chart changes. The reach is naturally deep and no

maintenance is anticipated for the recommended channel dimensions of 16 feet MLLW by 250 feet wide. Any adjustments to channel markers will be addressed at such time as the South Carolina State Highway Department begins construction of the new Highway 17 bridges.

**5.1.4 Operation and Maintenance.** ER 1165-2-131, *Local Cooperation Agreements for New Start Projects*, requires that where advance maintenance is practiced, the advanced maintenance quantities become part of the without-project condition. Removal of the material within the dimensions of the existing project should be treated as part of operations and maintenance. However, this principle applies only to that portion of the channel where advance maintenance dredging has been historically required for economic maintenance of the existing project.

Allocation of costs to the deepening project would include the dredging quantities to the new channel depths, less the quantities of sediment in the channel which would be dredged for normal maintenance of the existing project. A calculation of maintenance quantities and costs would be performed before the dredging. The calculation would be based on current predredging survey practices to identify maintenance quantities based on the shoaling condition at the time of the survey.

**5.1.5 Annual Maintenance.** The project area will undergo adjustment after construction. Once equilibrium is reached the areas of the channel with historical shoaling will continue the shoaling pattern. A dramatic increase of shoaling will be experienced in the Daniel Island Reach where the channel area essentially doubled. The estimated amount of annual maintenance required in the Daniel Island Reach is expected to be nearly 221,000 cubic yards with the restoration of the two existing contraction dikes and addition of the third. Without the contraction dikes, the maintenance quantity for the Daniel Island Reach would be in excess of 377,000 cubic yards annually. Increased shoaling quantities predicted on an annual basis are estimated to be 652,700 cubic yards with an increased maintenance cost for dredging and diking of \$930,000. The present practice of advance maintenance would be applied to the maintenance of the new channel depth.

## **5.2 Disposal Plan**

The least cost environmentally responsible disposal plan was developed. Considerations taken into account to reach this plan included the capacity of each disposal site, easement limits, and environmental concerns. The material removed from the widening of Daniel Island Reach and berthing area at Daniel Island Terminal will be taken to the ODMDS.

The ODMDS will be used for the reaches from the entrance channel to Drum Island

Reach including Wando, Custom House, Tidewater, and Lower Town Creek Reaches, and the turning basin at the Wando Terminal. This site can only be used for material which is determined to be suitable for offshore disposal by the Environmental Protection Agency.

Material from all remaining reaches will be taken to the Clouter Creek Disposal Site.

The Morris Island Disposal Site, the disposal site at the Naval Weapons Station, and Yellowhouse Creek Disposal Site were not found to be more economical than the others for initial project construction. The Drum Island disposal site has a limited capacity and was not projected to have sufficient capacity at the time of project construction to be considered for use by this project. The selected plan allows for conservation of valuable upland dredged material disposal sites while providing the least-cost construction plan for the project.

### **5.3 Environmental Impacts**

**5.3.1 Environmental Effects.** This project is not expected to result in unacceptable environmental impacts. Temporary effects will be experienced during the construction period such as increased turbidity in the water from the dredges and offshore from material settling to the bottom in the ODMDS. Similarly, organisms will be displaced during construction but re-establishment will occur following dredging activity. The environmental assessment located in this report prior to the Exhibits, provides a more detailed explanation of the effects on the environment from this project.

**5.3.2 Cultural Resources.** Following coordination with the State Historic Preservation Office (SHPO), a magnetic and acoustic survey of the navigation channel and new work areas was conducted in the summer of 1994. SHPO requested that all new areas of the proposed channel be thoroughly surveyed as well as identifying the exact location of the USS Patapsco. The Patapsco was an iron clad vessel sunk in Charleston Harbor near Fort Sumter. The wreck had never been definitively located but thought to be near the Federal channel. Since the vessel went down with her crew, the SHPO was anxious to preserve the site. The survey resulted in the identification of 32 magnetic and/or acoustic anomalies. Of the 32 targets located by remote sensing, 26 could be identified as modern debris on the basis of data generated during the magnetic and acoustic survey. Of the remaining six targets, only two were located near the navigation channel where they might be subject to impacts from this project. A diving reconnaissance was conducted on these two sites in April 1995. Both targets were identified as modern debris. In addition to the insignificant targets, the Patapsco was located and determined to be outside the boundary of impact from the proposed project.



**5.3.3 Mitigation.** Two primary habitat types will be impacted by construction of the contraction dike along the Cooper River. The new 700-foot long dike will displace subtidal estuarine bottom with rip rap - marl type material. Subtidal bottom provides habitat for a variety of benthic and bottom dwelling organisms. These organisms will be displaced in favor of hard surface, reef type habitat and associated organisms. The existing contraction dikes attract a multitude of sport fishes and are favorite fishing sites for local sports fishermen.

A second type of habitat affected by the contraction dike will be wetlands. Less than one acre of wetlands will be displaced at the junction of the dike with the uplands. The value of tidal wetlands to the environment is well documented in the literature. Therefore, in-kind mitigation of the wetlands impacts will be addressed following a determination of the exact location and preliminary design of the contraction dike.

#### **5.4 Plan Benefits**

A summary of project costs and benefits is shown in Table 8. The total investment cost is \$123 million, yielding a benefit/cost ratio of 1.82. The net average annual benefits for the selected plan are \$8,810,000.

## **6. Plan Implementation**

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### **6.1 Design and Construction**

PED is scheduled to begin in April 1996 and construction in 1998. During the PED phase, primary activities will involve geological investigations to determine the characteristics of material in the entrance channel extension for construction and preparation of plans and specifications.

**6.1.1 Construction Period.** The construction period is estimated to require four years to complete the project. Dredging in the entrance channel will be limited to the allowed period during the dredging window of 1 December thru 31 March. This window can be extended to 1 November thru 31 May if an observer is aboard the dredge during operation. Construction will begin with the entrance channel and continue up the Cooper River to the North Charleston Terminal with Lower Town Creek, Wando Reach and Shipyard River included.

**6.1.2 Project Monitoring Plan.** The project area will be monitored for changes in shoaling patterns by continued analysis of condition and pre- and post-dredging hydrographic surveys. The ODMS will be monitored during the construction phase of the project based on the Monitoring and Management Plan and in coordination with resource agencies.

### **6.2 Cost Apportionment**

The total FY 1995 project first cost for the selected plan is estimated to be \$116,639,000 as shown in Table 9.

**6.2.1 Fully-Funded Cost.** The current fully-funded cost estimate for the selected plan, based on 1995 dollars, includes an estimate of interest during construction based on the tentative construction period of four years. The Federal and non-Federal shares in the cost of the project are based on the fully-funded cost estimate carried to the mid-point of construction.

**6.2.2 Non-Federal Cost Sharing.** For Federal deep-draft navigation projects between 20 feet and 45 feet deep the non-Federal cost share is 25 percent of the construction cost of the general navigation features. The non-Federal sponsor must also pay an additional 10 percent cash with credit for any lands, easements, rights-of-way, relocations, and disposal sites including diking costs (LERRD) applied against the additional 10 percent cash. Based on the guidance provided in EC 1165-2-141, March 15, 1988, this cost share formula also applies to the entrance channel which is dredged to depths below 45 feet (to 47 feet, exclusive

Table 9  
Charleston Harbor Study  
Allocation of Costs for  
Recommended Plan  
and Without-Project Modifications  
(Thousands of 1995 Dollars)

Item	Apportionment of Costs		
	Total	Federal	Non-Federal
<b>Summary of First Costs</b>			
GNF	97,773	73,330	24,443
Without Project Safety Mod.	10,309	7,732	2,577
GNF Total	108,082	81,062	27,020
<b>Other Federal Costs</b>			
Aids to Navigation	78	78	
<b>Non-Federal Costs</b>			
LERRD Costs			
Disposal Diking	2,449		2,449
Real Estate	17		17
Total LERRD	2,466		2,466
Berthing Areas	6,012		6,012
Total Non-Federal Costs	8,479		8,479
Total First Costs	116,639	81,140	35,499
10% Shared Costs less LERRD		(8,342)	8,342
Total		72,798	43,841

of overdepth). The increased depth in the entrance channel is necessary for safe navigation to provide adequate underkeel clearance to vessels experiencing magnified effects from ocean waves. In addition, all costs associated with deepening berthing areas to meet the channel depth of the NED plan will be paid by the users.

As provided in Section 101 of the Water Resource Development Act of 1986, the non-Federal share consists of 25 percent of the general navigation features to be paid during the construction and an additional 10 percent, less LERRD, to be paid over a period of not to exceed 30 years at an interest rate pursuant to Section 106 of the Act of 1986.

### **6.3 Division of Responsibilities**

In addition to the cost sharing responsibilities discussed in the previous paragraph, the following paragraphs outline additional Federal and non-Federal responsibilities in connection with development of general navigation projects, as mandated by WRDA 1986, Public Law 99-662, and other pertinent laws and policy guidance.

**6.3.1 Federal Responsibility.** The Corps of Engineers will prepare and provide detailed plans and specifications necessary to award a contract. The Corps of Engineers will continue maintenance of the existing authorized Federal navigation channel and Federal navigation channels resulting from this project. The Corps of Engineers will provide necessary permits for construction of this project and assist in permitting needs associated with the new Daniel Island Terminal. Congress will authorize the project and appropriate Federal funds for its construction.

**6.3.2 Non-Federal Responsibility.** In addition to contributing the non-Federal share of the construction funds as described in paragraph 6.2.2 and that based on the guidance provided in ER 1165-2-131, *Local Cooperation Agreement for New Start Construction Projects*, the non-Federal partner will:

- a) Provide and maintain, at its own expense, the local service facilities. All berthing areas will be maintained at the project depth of 45 feet at all commercial terminals, piers, and docks.
- b) Provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, and maintenance of the general navigation features and the local service facilities.
- c) Provide all improvements required on lands, easements, and rights-of-way

to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the general navigation features and the local service facilities.

d) Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation features:

\*25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;

e) Repay with interest, over a period of not to exceed 30 years following completion of the period of construction of the Project, an additional 0 to 10 percent of the total navigation features depending upon the credit given for the value of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas provided by the Non-Federal Partner for the general navigation features. If the amount of credit exceeds 10% of the total cost of construction of the general navigation features, the Non-Federal Partner shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas, in excess of 10% of the total cost of construction of the general navigation features.

f) For so long as the Project remains authorized, operate and maintain the local service facilities and any dredged or excavated material disposal areas, in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government.

g) Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Partner owns or controls for access to the general navigation features for the purpose of inspection, and if necessary, for the purpose of operating and maintaining the general navigation features.

h) Hold and save the United States free from all damages arising from the construction, operation, and maintenance of the Project, any betterments, and the local service facilities, except for damages due to the fault of negligence of the United States or its contractors.

i) Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project, for a minimum of three years after completion of the accounting for which such books, records,

documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20.

j) Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, and maintenance of the general navigation features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the Non-Federal Partner with prior specific written direction, in which case the Non-Federal Partner shall perform such investigations in accordance with such written direction.

k) Assume complete financial responsibility, as between the Federal Government and the Non-Federal Partner, for all necessary cleanup and response cost of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, or maintenance of the general navigation features.

l) To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA.

m) Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, and maintenance, of the general navigation features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

n) Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

o) Provide a cash contribution equal to the following percentages of total historic preservation mitigation and data recovery costs attributable to commercial navigation that are in excess of one percent of the total amount authorized to be appropriated for commercial navigation:

\*25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;

#### **6.4 Non-Federal Partner's Support**

**6.4.1 Non-Federal Partner's Views.** The South Carolina State Ports Authority enthusiastically supports the proposed project to deepen the federal navigation channel to a depth of 45 feet with channel improvements in the Shutes/Folly Reach and Daniel Island Reach. In addition, during the early stages of this phase of the study the SCSPA requested an accelerated study schedule in order to meet the deadline for submission to the Water Resource Development Act of 1996. The sponsor has provided full cooperation to meet this goal and is prepared to meet necessary financial obligations associated with this project.

**6.4.2 Non-Federal Partner's Financial Plan.** The non-Federal partner has provided a tentative financial plan. The plan has been reviewed and found to be in compliance with requirements for ensuring that the non-Federal partner has a reasonable plan for meeting its financial commitment. The non-Federal partner's plan is to fund their share of project costs from the South Carolina Legislature. In the event such funding is not available from the South Carolina Legislature, the South Carolina State Ports Authority is prepared to fund their portion of the project construction cost by an accumulation of cash before and during construction plus the sale, if required, of Revenue Bonds. The South Carolina State Ports Authority (SCSPA) is a state agency which generates revenues through assessment of port fees to shipping firms that use their facilities. The SCSPA has a positive cash flow and exercises sound management practices. SCSPA issued bonds in 1994 to finance the expansion of Wando Terminal. Bonds were also issued in 1988 to finance the 40-foot project. SCSPA has provided their share of feasibility study costs amounting to \$1,360,000 from their funds without the aid of financing.

## **7. Coordination and Public Involvement**

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Throughout the study close coordination was maintained to ensure a thorough investigation was conducted on all issues. In addition, participation of harbor pilots, WES engineers, other Federal and state agency representatives, and SCSPA was on a regular basis. The SCSPA was given formal updates on study progress as requested as well as providing technical review to South Atlantic Division (SAD) and Headquarters at the Technical and Feasibility Review Conferences.

Close coordination with SCSPA engineers and planners was invaluable in the channel design for the Daniel Island Reach modeled in the ship simulation study at WES. By having both agencies interacting during the infancy of the modeling process, both sides were able to provide valuable insight on navigation and port terminal operation as well as retain critical needs for the respective goals. The Corps of Engineers was able to influence the location of the new terminal to ensure a safe navigation channel was provided while the SCSPA was able to make the best possible use of their land for container terminal operation.

The U.S. Fish and Wildlife Agency was involved throughout the study as required by the Fish and Wildlife Coordination Act of 1958, as amended. Their final report is included in this document.

Meetings were held with various environmental agencies to evaluate beneficial use of dredged material. Interest was expressed by the agencies, however, they are concerned about the suitability of the material for bird nesting habitat. Coordination with the resource agencies will continue through PED.

WES model studies included coordination with the harbor pilots, docking pilots, district personnel, SCSPA personnel, Coast Guard, and Navy personnel. The modeling process required historical data which was provided by all listed parties.

Aside from the agencies mentioned above, public involvement was included in this study by means of a published joint public notice dated 9 December 1994.

The Draft Feasibility Report was mailed to a comprehensive list of agencies and individuals to give them an opportunity to review and comment on the recommendations.



## **8. Conclusions and Recommendations**

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I have given full consideration to all significant aspects of this study in the overall public interest, including engineering and economic feasibility, as well as social and environmental effects. The selected plan for improvement described in this report provides the optimum solution for navigation improvements at Charleston Harbor, South Carolina.

I have also assessed the South Carolina State Ports Authority's financial capability and ascertain that it is reasonable to expect that ample funds will be available to satisfy the non-Federal partner's financial obligation for the project. The Authority's letter of intent to sponsor the project is included as an exhibit to this report.

I recommend that the existing Federal navigation project at Charleston Harbor, authorized by the River and Harbor Act of 1983, have the following improvements made;

1) The width of the Daniel Island Reach will increase from a continuous 600-foot wide channel to 875 feet wide at Myers Bend tapering back to 600 feet at Daniel Island Bend. A new turning basin and berthing area will be included in this reach to accommodate the vessels calling on the new Daniel Island Container Terminal.

2) The entrance channel be modified to 800-foot wide at a depth of 47 feet below MLLW from the 47-foot ocean contour transitioning to a depth of 45 feet below MLLW near station 0+00. This channel will extend 16.3 miles oceanward from station 0+00 which is located within the Charleston Harbor jetties.

3) The channel will continue from approximately station 0+00 at a depth of 45 feet below MLLW to the North Charleston Terminal including the Wando River, Shipyard River entrance channel and Turning Basin A, and Custom House Reach to station 73+33 of Lower Town Creek Reach. The widened Daniel Island Reach channel as described above will also be deepened to 45 feet below MLLW. The turning basins at the North Charleston, Wando, and Columbus Street Terminals will be included.

4) The existing channel alignment in the Shutes, Folly and Horse Reaches will be realigned.

5) Construction of a new contraction dike located approximately 200 feet to the north of the Navy's degaussing pier along the west side of Daniel Island Reach. In addition, restoration of the two existing contraction dikes located along the west

side of the Daniel Island Reach and the removal of the existing contraction dike on Daniel Island.

6) The Upper Town Creek Reach will have a channel width of 250 feet from the Cooper River bridges to Myers Bend with a channel depth of 16 feet below MLLW.

All structures will be distanced at least 125 feet from the edge of the Federal navigation channel. In addition, no dredging will be performed outside the Federal navigation channel by the United States at Federal expense. The non-Federal Sponsor shall comply with all requirements outlined in Section 6.3.2.

Further modifications may be made at the discretion of the Chief of Engineers when advisable. The total initial construction cost is estimated to be \$116,639,000. Increased annual Federal maintenance costs associated with this project are estimated to be \$1,010,000. The estimated annual total project cost, including maintenance costs, is \$10,701,000. With estimated average annual benefits of \$19,511,000 in delay savings and commodity costs, the proposed project is economically feasible with a B/C ratio of 1.82 and annual net benefits of \$8,810,000, thereby warranting Federal participation. Accordingly, the non-Federal cost share is estimated to be \$27,020,000 for 25 percent of the general navigation features. The partner shall pay an additional 10 percent of the cost of the general navigation features of the project in the amount of \$10,808,000 plus interest, in cash payable over a period not to exceed 30 years. The value of lands, easements, rights-of-way, relocations, and dredging material disposal areas shall be credited towards the additional 10 percent.

The recommendations contained herein reflect the information available at this time and current Department policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of national Civil Works Construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and/or implementation of funding.

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Date: \_\_\_\_\_

THOMAS F. JULICH  
Lieutenant Colonel, EN  
Commanding

## **ENVIRONMENTAL ASSESSMENT**

### **CHARLESTON HARBOR DEEPENING/WIDENING CHARLESTON HARBOR, SOUTH CAROLINA**

#### **INTRODUCTION**

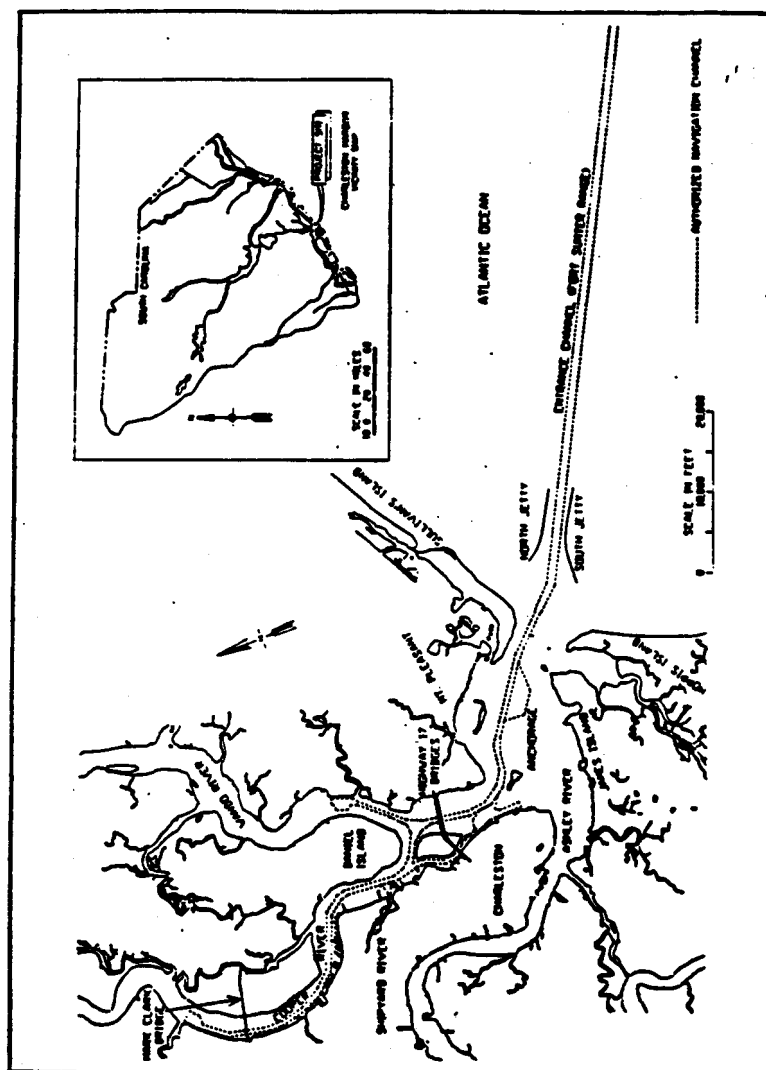
##### **A. Project Authority and Purpose**

Resolutions adopted by the Senate on March 27, 1990 and by the House of Representatives on August 1, 1990 authorized the U.S. Army Corps of Engineers to study Charleston Harbor and determine if any modifications should be made to the existing Charleston Harbor Project, with particular emphasis on deepening and/or widening the federal navigation channel.

##### **B. Project Location and Description**

The Charleston Harbor federal navigation channel is located in Charleston Harbor, South Carolina which lies approximately midway along the South Carolina coastline. It is approximately 140 statute miles southwest of the entrance to Cape Fear River, North Carolina and 75 statute miles northeast of the Savannah River, (see Figure 1).

The proposed project consists of deepening Charleston Harbor from a depth of 40 feet to 45 feet below mean low water (MLW) with two (2) feet of advance maintenance and two (2) feet of allowable overdepth. Furthermore, the project will also include realignment of the channel at Horse Reach and Shutes/Folly Reach to improve navigation by straightening the channel. The entrance channel will be 47 feet deep and 800 feet in width from the 47-foot ocean contour to station 0+00 inside the jetties. The channel will slope upward to 45 feet and remain at 800 feet wide to a point adjacent to Sullivan's Island where it will narrow to 600 feet wide. The remainder of the navigation channel will remain at the present 500 to 800 feet wide with the following exceptions. The Daniel Island Reach will vary from approximately 600 feet to 875 feet in width for the proposed terminal access and include a turning basin approximately 1200 feet in length. Upper Town Creek will be reduced to 16 feet deep and 250 feet wide. The entrance channel will not be deepened in any area where the present depth is already at 47 feet. In addition, two existing contraction dikes located on the west side of the



Cooper River, across from the proposed new Daniel Island Terminal will be refurbished. The existing contraction dike located at Daniel Island will be removed and a new 700 foot long contraction dike located approximately 150 feet upstream of the degaussing pier on the west side of the Cooper River will be constructed, (See Figure 2).

## **ENVIRONMENTAL SETTING**

### **A. General Description of the Area**

The harbor covers an area of approximately 14 square miles and is formed by the confluence of the Ashley, Cooper, and Wando Rivers. The City of Charleston is located to the west of the harbor, James Island and Morris Island to the south, Mt. Pleasant and Sullivan's Island to the north and the Atlantic Ocean to the east. The majority of upland areas around Charleston Harbor are composed primarily of residential, commercial, and industrial development. Docking and maintenance facilities of the harbor are concentrated along the west shore of the Cooper River extending from Battery Point of the peninsular city to the mouth of Goose Creek.

The Cooper River has its origin at the confluence of its East and West Branches (locally termed "The Tee") from which it flows 32 miles southward to its outlet in Charleston Harbor. The East and West Branches of the Cooper River extend some 20 miles inland in a northward direction to their origins as small ill-defined channels in a low-lying area of Berkeley County known as Ferguson Swamp.

The Ashley River originates in the coastal plain and flows into the western part of Charleston Harbor. Areas of the river are bordered by historic plantations, a large portion of the Ashley River Basin is now occupied by residential or commercial development.

The Wando River originates in the coastal plain and flows into the eastern part of Charleston Harbor. Portions of the lower Wando River are bordered by marsh which changes to woodland in the upper reaches of the river. Development along the Wando River has been encouraged with recent completion of an interstate highway system. At present, residences and subdivisions are present along stretches of the river as are a shipyard and the State Port Authority's Wando River Terminal.

### **B. Water Quality**

Water quality in Charleston Harbor is classified as SB by the South Carolina Department of Health and Environmental Control, (SCDHEC). The SB rating applies to tidal salt water suitable for primary and secondary contact recreation, crabbing, and fishing, except for the harvesting of clams, mussels, or oysters for market purposes or consumption. These waters are also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora. Waters rated as SB should not have dissolved oxygen concentrations less than 4 mg/l and fecal coliform concentrations should not exceed a geometric mean of 200 colonies/100 ml based on five consecutive samples taken within a 30 day period. Although these concentrations have been exceeded occasionally, recent review of data collected by SCDHEC indicate that water quality within the harbor basin often meets SB standards for dissolved oxygen and fecal coliform levels.

Water quality in the Wando River is classified SFH (Shellfish Harvesting Waters) for the portion of the river from its headwaters to a point 2.5 miles upstream of its confluence with the Cooper River. This classification applies to tidal saltwaters protected for shellfish harvesting. SFH water must maintain a daily average dissolved oxygen concentration of 5 mg/l or higher with a low of 4 mg/l and have median coliform concentrations of 14 colonies/100 ml with no more than 10% of the samples exceeding 43 colonies/100 ml. For the portion of the Wando River from its confluence with the Cooper River to a point 2.5 miles upstream, the river is classified as SA waters. SA waters have the same designated uses as SB waters, although the water quality standards are stricter for dissolved oxygen. SA waters require a daily average of dissolved oxygen of not less than 5 mg/l with a low of 4 mg/l.

**C. Hazardous and Toxic Waste.**

The proposed project is primarily located in the existing navigation channel where dredging occurs on a twelve to eighteen month rotation. Because of the frequent dredging activity, it was not expected that any hazardous or toxic waste would be encountered. However, bulk sediment chemistry was conducted on the sediments proposed for the deepening project. The analysis indicated that hazardous and toxic material is not present in the sediments.

**D. Sediment Analysis.**

To obtain Section 401 Water Quality Certification and Section 103 approval for ocean disposal of the material, sediment testing for physical, chemical, and biological parameters was conducted on maintenance and deepening material (including new work areas). Analytical results indicated that the vast majority of sampling sites

required no further testing. However, polynuclear aromatic hydrocarbon (PAH) concentrations were notably higher at two sites, one in Shipyard River and one in the Cooper River near the proposed Daniel Island Terminal site. All analytical data was submitted to the Environmental Protection Agency (EPA) for review to determine if additional testing was needed for ocean disposal. Correspondence from EPA dated May 18, 1995 required no additional testing at any site, with the exception of PAH tissue testing at the two sites mentioned above. Bioaccumulation studies have been completed, and analytical results were received in October 1995 and submitted to EPA for review. Correspondence from EPA dated November 14, 1995 approved material from all but one site, CH-3, for ocean disposal.

#### **E. Threatened and Endangered Species**

The U.S. Fish and Wildlife Draft Coordination Act Report dated December 1994, advised the Corps that the following federally listed endangered (E) and threatened (T) species are known to occur in Charleston County, South Carolina:

West Indian manatee (*Trichechus manatus*) - E  
Bald eagle (*Haliaeetus leucocephalus*) - E  
Bachman's warbler (*Vermivora bachmanii*) - E  
Wood stork (*Mycteria americana*) - E  
Red-cockaded woodpecker (*Picoides borealis*) - E  
Arctic peregrine falcon (*Falco peregrinus tundrius*) - T  
Piping plover (*Charadrius melodus*) - T  
Kemp's ridley sea turtle (*Lepidochelys kempi*) - E  
Loggerhead sea turtle (*Caretta caretta*) - T  
Leatherback sea turtle (*Dermochelys coriacea*) - E  
Green sea turtle (*Chelonia mydas*) - T  
Shortnose sturgeon (*Acipenser brevirostrum*) - E  
Canby's dropwort (*Oxypolis canbyi*) - E  
Pondberry (*Lindera melissifolia*) - E  
Sea-beach pigweed (*Amaranthus pumilus*) - T  
Chaff-seed (*Schwalbea americana*) - E

The National Marine Fisheries Service advised on January 11, 1995 that the following endangered (E) and threatened (T) species and critical habitats are listed under that agency's jurisdiction in South Carolina:

Finback whale (*Balaenoptera physalus*) - E  
Humpback whale (*Megaptera novaeangliae*) - E  
Right whale (*Eubaleana glacialis*) - E

Sei whale (*Balaenoptera borealis*) - E  
Sperm whale (*Physeter catodon*) - E  
Green sea turtle (*Chelonia mydas*) - T  
Hawksbill sea turtle (*Eretmochelys imbricata*) - E  
Kemp's (Atlantic) ridley sea turtle (*Lepidochelys kemp*) - E  
Leatherback sea turtle (*Dermochelys coriacea*) - E  
Loggerhead sea turtle (*Caretta caretta*) - T  
Shortnose sturgeon (*Acipenser brevirostrum*) - E

Species proposed for listing - None  
Listed critical habitat - None  
Proposed critical habitat - None

Additional correspondence from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) dated March 6, 1995 and January 30, 1995, respectively, provide documentation that the District has concluded its consultation responsibilities under Section 7 of the Endangered Species Act.

#### **F. Cultural Resources**

The City of Charleston is one of the oldest permanent settlements in the United States and has many areas and structures of great significance in the history of the country from the Revolutionary War and the Civil War to the Reconstruction period. Prominent among these are:

1. Charleston Historical District located on the lower third of peninsular Charleston.
2. Fort Sumter National Monument located off an island at the entrance to Charleston Harbor.
3. Site of Old Charles Town located on Albemarle point.
4. Castle Pinckney located on Shute's Folly.
5. Middleton, Magnolia and Drayton Hall Plantations located along the Ashley River and Boone Hall Plantation located in Mount Pleasant.

Following coordination with the State Historic Preservation Office (SHPO), a magnetometric survey of the navigation channel and new work areas was conducted in



the summer of 1994. The survey resulted in the identification of 32 magnetic and/or acoustic anomalies. Of the 32 targets located by remote sensing, 26 could be identified as modern debris on the basis of data generated during the magnetic and acoustic survey. Of the remaining six targets, only two were located near the navigation channel where they might be subject to impacts from this project. A diving reconnaissance was conducted on these two sites in April 1995. Both targets were identified as modern debris. The draft archeological report for this project was submitted to the SHPO on June 1, 1995 with a request for comments. Final copies of the archeological report were received by this office in August 1995. Correspondence from the SHPO office dated September 7, 1995 provided concurrence with the district determinations that no cultural or historic resource would be impacted by this project (see EA Appendix).

## **POTENTIAL IMPACTS OF THE PROPOSED ACTION**

### **A. Benthic Impact.**

One of the most significant short-term impacts of hydraulic dredging is the destruction of benthic invertebrates in the path of the dredge cutterhead. The greatest concentration of benthic invertebrates in the Charleston Harbor estuary occur in and around salt marshes in lieu of the deeper channelled areas. Much of the salt marsh in the project area provides suitable habitat for invertebrates including fiddler crabs, oysters, and mollusks such as the common marsh periwinkle snail. Polychaete worms, are found on a wide variety of substrates and are common in salt marshes. Deepening in the present navigation channel, where maintenance of reoccurring shoals are dredged on a 12 to 18 month rotation, will not significantly effect benthos. The majority of benthic impacts will be located in the realignment areas of Horse reach and Shute's/Folly reach; Channel widening of the Daniel Island reach; construction of a new contraction dike; and the new ships turning basin. The benthic impacts in these areas would however, be temporary as invertebrates including polychaetes will recolonize the disturbed areas in a short time.

### **B. Water Quality.**

1. Temporary changes in water quality at the dredging and disposal sites are expected; however, permanent changes in water quality due to this project are not anticipated or expected. A Section 401 Water Quality Certification was issued for upland disposal of dredged material associated with the project by the South Carolina Department of Health and Environmental Control (SCDHEC) on May 2, 1995. Further, the SCDHEC, Office of Ocean and Coastal Resource Management provided

certification that the deepening project was consistent with the Coastal Zone Management Program by letter on March 10, 1995 (see EA Appendix). An amended Coastal Zone Consistency was received on February 1, 1996 and the Section 401 is anticipated in March 1996 for placement of the contraction dike, refurbishment of the existing dikes, removal of the Daniel Island contraction dike, and dredging of the proposed Daniel Island Turning Basin.

2. Correspondence from the South Carolina Department of Natural Resources dated February 6, 1995 reported that the top of the Cooper Formation lies between the approximate elevations of -10 and -60 feet mean sea level with thickness varying from 200 to 260 feet. As a result, no adverse impacts to the existing aquifers is expected as a result of deepening Charleston Harbor a maximum of five feet (see EA Appendix).

3. Hydrodynamic, salinity intrusion and sedimentation models were conducted by the Army Corps of Engineer, Waterways Experiment Station for this project. The numerical models were used to develop the channel velocities and water levels for the base condition and the proposed conditions in support of the ship simulation and the sedimentation study. The salinity intrusion model indicated that no significant difference was found between the existing -40 foot channel and the proposed -45 foot channel. Because the channel will be deeper and wider in specified areas, the sedimentation model indicated that there will be an increase in the expected sedimentation compared to present conditions. It is however, considered a manageable and acceptable increase. Additional information and detail concerning the models are found in Section 4.1.4 Increased Annual Maintenance.

#### **C. Endangered/Threatened Species**

Official lists of endangered/threatened species have been requested and received from the USFWS and the NMFS (see Section E, ENVIRONMENTAL SETTING). The only potential impacts of harbor deepening on the listed species are as follows:

There are potential impacts to threatened/endangered sea turtles related to hopper dredging in the entrance channel. However, these impacts will be reduced/eliminated by the use specialized equipment, monitoring by trained observers, and/or compliance with a dredging window (1 November - 31 May, or whatever the window may be at the time of dredging). Further, hydraulic dredging (pipeline) discharging into scows will be utilized to remove the harder material (coquina) and during the turtle season when hopper dredges cannot be used. In addition, measures to provide manatee protection if construction occurs during summer months (June through September) has been included in the project and will be incorporated in

the plans and specifications. The USFWS and the NMFS have concurred with this determination and have indicated that Section 7 Consultation with the District has concluded, (see EA Appendix).

Further, recommendations provided by the USFWS in the Draft Coordination Act Report, 1994 have been responded to in this document and/or have been taken into consideration for planning and contract purposes (see EA Appendix).

**D. Land Disruption.**

Not applicable.

**E. Wetlands.** Construction of the new contraction dike will require the excavation of a corridor through a fringe of Spartina wetlands. This excavated corridor will be approximately 80 feet wide by 1000 feet in length total (approximately 500 feet will be in marsh). This corridor will be excavated down to -10 MLLW. Once the corridor is excavated to the approximate dimension a dredge will be used to pump approximately 280,000 cubic yards of marl on the bottom of the excavated corridor bringing the bottom up to elevation - 4.0 MLLW. After the marl base is in place, 0.5 " corrugated metal sheet pilings will be driven into it creating the desired contraction dike. Approximately 4,000 cubic yards of 12" to 24" stone will be placed along both sides of the sheet piles for the entire length of the dike for stabilization. A layer of riprap will then be placed on top of the stone to act as a cap to hold the stone in place. Stockpiled marsh material from the original excavation will be returned to the 80 by 500 foot marsh area and placed on each side of the sheet pile contraction dike to the same elevation and slope as the original and adjacent marsh. Spartina is expected to quickly reestablish itself naturally in this disturbed area. All marl, stone foundation blanket and riprap will be below elevation - 00 with approximately 5.5 feet of fine grained material on top of the 80 foot by 500 foot marsh area. The contraction dike will be anchored on its landward end with riprap. Some of the riprap anchor will by necessity, be toed into the edge of the marsh to prevent scouring on high tides.

**F. Noise.**

There would be an increase in the ambient noise level during the dredging phase of the project. However, the noise level would be no different than that experienced during normal maintenance dredging.

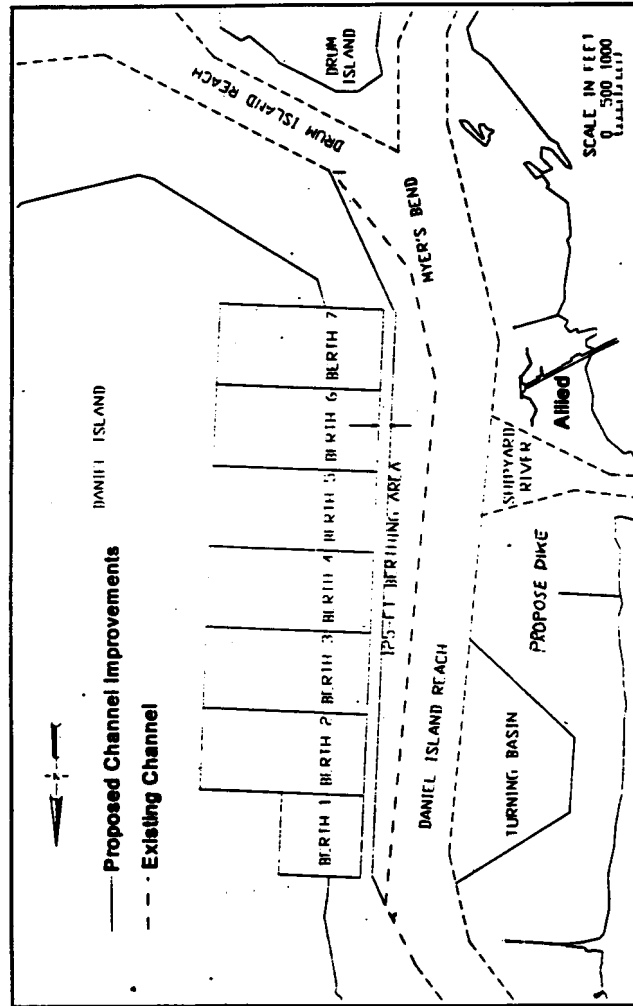


Figure 2: Daniel Island Terminal location

**G. Air Quality.**

Any increase in air pollution would be due to exhaust from the dredging equipment. The increase would be minor and temporary. Further, the entire state of South Carolina is an attainment area for standard pollutants at this time. The dredge is a mobile source and is not regulated by the state of South Carolina. It is not anticipated that the dredged material will be rehandled in a dry state after its initial placement.

**H. Flora.**

Not applicable.

**I. Fishery.**

Given the length of the study area and the scope of the proposed project, the fishery resource of Charleston Harbor would not be significantly impacted by the proposed project. This premise is substantiated in the Final Environmental Impact Statement for the Charleston Harbor Deepening Project, Charleston Harbor and Shipyard River, South Carolina, U.S. Army Engineer District, Charleston, South Carolina, April 1976, and associated references as listed in that document.

**J. Cultural Resources.**

The cultural resource investigation is complete. No cultural or historical resources were identified in the study area.

**K. Dredged Material Disposal.**

1. Quantities of material dredged and proposed disposal locations are identified and described in Section 3.2.3.

2. The environmental impact statement (EIS) written for the designation of the Charleston Ocean Dredged Material Disposal Site (ODMDS) addressed impacts associated with the disposal of dredged material at the site. Further studies indicating the presence of live bottoms in the western portion of the site have resulted in avoidance of disposal in that area and the development of an EPA/Corps Management and Monitoring Plan for the ODMDS. In addition, suitable material, ie. rock, marl, coquina, are utilized for construction of a berm within the disposal area to

prevent/reduce impacts to the live bottom areas whenever possible. Impacts associated with this dredging activity would be the same as those addressed in the ODMDS EIS and covered by the management plan.

3. All of the upland dredged material disposal sites proposed for use during this project are existing sites and have been utilized for dredged material disposal for many years. These areas are utilized on a consistent basis for dredged material disposal, so would not be suitable for management as wildlife habitat. Ultimately, the use and value of these areas will remain the same following completion of the proposed project.

4. Other alternative disposal sites other than those mentioned above are discussed in the Daniel Island Alternatives Study, 1993. Based on that study, the disposal sites proposed for use in this project are considered the least environmentally damaging and provide the least cost alternatives.

#### **UNAVOIDABLE ADVERSE IMPACTS**

Adverse environmental effects associated with this project are as follows:

There would be a temporary increase in noise and air pollution during the construction phase of the project.

There would be a temporary increase in turbidity which would have a temporary impact on water quality at the dredging and ocean disposal locations.

Impacts to benthic organisms at dredging sites is expected.

Impacts to Spartina marsh is expected at the construction site for the proposed contraction dike.

#### **ALTERNATIVES TO THE PROPOSED ACTION**

Alternatives to the proposed action include:

A. Various depths for deepening the navigation channel were examined. Proposed depths include -41 to -46 feet mhw. The economic evaluation for this project will play a significant role in determining the final project depth.

B. Alternatives for realignment were considered by WES and studied using sedimentation and ship simulation models. The proposed realignment is expected to provide optimum navigation with minimal sedimentation and environmental impacts.

C. The no-action alternative is not considered a viable option because of the navigation hazard associated with the present alignment, and because the purpose of the study was to determine if modifications to the present channel were advisable. Studies indicate that the proposed project modifications are advisable.

D. Disposal options for the material included ocean disposal and upland disposal at dredged material disposal areas. A meeting was held in September 1994 with state and federal agencies to discuss possible beneficial uses of the dredged material. Potential uses included nesting habitat, and beach or island renourishment. Potential locations for disposal included Morris Island Beach, Folly Beach, Bird Key, Castle Pinckney, Crab Bank, Morris Island Lighthouse, Ft. Sumter, placement for drift to beaches south of Charleston, and Daniel Island.

The chief drawback for use of proposed dredged material for any of the sites within the harbor is the grain size. Only suitable material which would be predominantly sand could be used for bird nesting or island renourishment. Material from the entrance channel is dredged using a hopper dredge. Placement of material on beaches would require the use of a hydraulic dredge which would increase the cost of disposal. An economic evaluation was conducted on the placement of material on Morris Island Beach as a beneficial use. Morris Island was studied because it is the closest potential site to the entrance channel, it is a disposal area for dredged material, and the oceanward side of the island is eroding. However, the benefit/cost ratio would not support this as a disposal site. Further, the local sponsor has indicated that any additional expense to the dredging and disposal activity would not be acceptable. State agencies expressed an interest in the beneficial uses of suitable material, but indicated that no funds were available to assist with the projects.

At the present time, additional coordination with resource agencies and the local sponsor is underway to determine the possibility of placing some material at Castle Pinckney and Crab Bank. Depending on the type of material and the logistics of placing the material in a beneficial location near the proposed sites, these locations may still be viable options.

## CONCLUSIONS


The proposed action does not constitute a major Federal action significantly affecting the quality of the human environment, therefore, the preparation of an Environmental Impact Statement (EIS) is not required. In addition, this project is consistent, to the maximum extent practicable, with the South Carolina Coastal Zone Management Program. Finally, the proposed action has been thoroughly assessed and coordinated and will not significantly affect the environment.

**FINDINGS OF NO SIGNIFICANT IMPACT  
CHARLESTON HARBOR DEEPENING/WIDENING PROJECT  
IN  
CHARLESTON COUNTY, SOUTH CAROLINA**

Based upon the attached Environmental Assessment and in consideration of other pertinent documents, I conclude that the environmental effects of the proposed Charleston Harbor Deepening/Widening Project are not significant and the preparation of an Environmental Impact Statement is not warranted. Specific factors considered in making the determination include the following:

1. Wetlands would not be significantly affected.
2. No land use changes would occur.
3. Air quality would not be significantly affected.
4. Water quality would not be significantly affected.
5. The project would have a negligible impact on fish and wildlife resources.
6. Construction activity would enhance shipping traffic and result in no significant effect on recreational boating.
7. The proposed action is in full compliance with the Endangered Species Act.

8 Mar 96  
DATE

  
Thomas F. Jdlich  
Lieutenant Colonel, U.S. Army  
District Engineer



## **EA APPENDIX INDEX**

Appendix A: 404(b)(1) Evaluation  
404(b)(1) Evaluation (amended)  
Appendix B: Section 401 Joint Public Notice  
Section 401 Joint Public Notice (amended)  
Appendix C: U.S. Fish and Wildlife Final Coordination Act Report  
Appendix D: Environmental Correspondence

## APPENDIX A

### 404(b)(1) EVALUATIONS

#### Charleston Harbor Deepening Project Charleston, South Carolina

##### I. PROJECT DESCRIPTION

a. Location. The project area is the Charleston Harbor federal navigation channel located in Charleston Harbor, South Carolina. The harbor is located approximately midway along the South Carolina coastline, being approximately 140 statute miles southwest of the entrance to Cape Fear River, North Carolina, and 75 statute miles northeast of the Savannah River.

b. General Description. The project consists of deepening Charleston Harbor from 40 feet to 42 feet as a minimum depth and 45 feet as a maximum depth below mean low water (MLW) with two (2) feet of advance maintenance and two (2) feet of allowable overdepth. Furthermore, the project will also include realignment of the channel at Horse Reach and Shutes/Folly Reach to improve navigation by straightening the channel. The navigation channel will be 800 feet in width beyond the jetties. Just prior to reaching the jetties from the ocean, the channel will remain at the present 1000 feet in width, returning to 800 feet at a point within the jetties. From 800 feet, it will reduce further to 600 feet wide adjacent to Sullivan's Island. No changes are proposed for the rest of the navigation channel which varies from 500 feet to 800 feet in width, with two exceptions. The Daniel Island Reach will vary from approximately 600 feet to 875 feet in width for proposed terminal access, and the Horse Reach and Shutes/Folly Reach, where realignment is proposed, will be 900 feet to 1000 feet in width. The entrance channel is expected to extend out to the 51-foot ocean contour. However, it should be noted that the entrance channel will not be deepened in any area where the present depth is already at 47 feet.

c. Authority and Purpose. This project is being undertaken as part of the following study authority: "Pursuant to Senate and House resolutions adopted on 27 March 1990 and 1 August 1990, respectively (the latter published as House Document Numbered 100-27, 100th Congress, 1st Session), the Charleston District, through the Board of Engineers for Rivers and Harbors, was requested to review the reports of the Chief of Engineers on Charleston Harbor, South Carolina with a view to determining whether any modifications of the project are advisable at this time, with particular view toward deepening and/or widening."

d. General Description of Dredged or Fill Material. Core borings were conducted during the previous deepening project. Borings collected at that time were collected at depths sufficient to address this deepening project also. Additional borings have been collected during the feasibility phase of this project. From the borings, it is concluded that there are three types of material that will be encountered during the

deepening project. The three types are overburden soils, the Cooper Marl formation and Coquina. Overburden soils consist of sands, silts, clays and loose shell formations overlying the predominate Cooper Marl or Coquina. The Cooper Marl formation is a consolidated, fine grained, impure calcareous deposit that lies between the elevations of -10 and -60 feet mean sea level with thicknesses varying from 200 to 260 feet in the project area. The marl is composed primarily of an olive-brown to olive sandy clayey silt with occasional layers of very silty clayey fine sand. Overlying the Cooper Marl at locations in the entrance channel is a light gray calcareous cemented sandy shell hash referred to as Coquina. Coquina is also the predominate material beneath the overburden soils in some locations in the entrance channel.

e. Description of the Proposed Discharge Site. Placement of the dredged material is expected to occur over a period of years during individual dredging contracts. Because  $\pm$  35 million cubic yards will be dredged, the majority of the material, if suitable, will be disposed of at the Charleston Ocean Dredged Material Disposal Site, (ODMDS). Additionally, disposal of the material will be made to upland contained disposal areas within economical pumping distance, where there is sufficient area for disposal or where the material is not suitable for ocean disposal. Existing upland areas which are under consideration for disposal include Clouter Creek Disposal Area, Daniel Island Disposal Area (if still under easement), Morris Island Disposal Area, the Naval Weapons Station Disposal Area, and Drum Island Disposal Area.

f. Description of Disposal Method. Hopper dredging will be used to dredge loose material in the entrance channel for ocean disposal. Hydraulic dredging (pipeline) discharging into scows will probably be utilized to remove the harder material (coquina) and during the turtle season when hopper dredges cannot be used. A clamshell dredge or hydraulic dredge will be used to excavate material in the inner channel if suitable for ocean disposal. The material will be placed in barges and transported to the ODMDS for disposal. Material determined to be unsuitable for ocean disposal or material that is located in the upper channel where the distance to the ODMDS makes transportation of the material economically infeasible will be hydraulically dredged, and the dredged material will be disposed of at an upland disposal site.

## II. Factual Determinations.

### a. Physical Substrate Determinations.

(1) Substrate Elevation and Slope. Present depths in the Charleston Harbor navigation channel include 42 feet plus two (2) feet of advance maintenance and two (2) feet of allowable overdepth in the entrance channel, and 40 feet plus two (2) feet of advance maintenance and two (2) feet allowable overdepth in the inner channel. This depth is maintained throughout the channel with the following exceptions: 38 feet in the Shipyard River Entrance Channel and Turning Basin A; 30 feet in Shipyard River Connector Channel and Turning Basin B, and 40 feet in Town Creek with 4 foot horizontal to 1 foot vertical side slopes. The side slopes will remain unchanged; however, the depth of the channel will be deepened to 42 feet minimum to

45 feet maximum with two (2) feet of advance maintenance and two (2) feet of allowable overdepth.

(2) Sediment Type. Sediment types are discussed in detail in part I.d. of this document.

(3) Dredged/Fill Material Movement. Dredged material will be moved by hopper dredge, hydraulic dredge and/or clamshell dredge and transported to the Charleston ODMDS for disposal. A hydraulic dredge will be utilized for pipeline transport and disposal of material at existing upland disposal sites.

(4) Physical Effects on Benthos. Benthic animals in the vicinity of the dredging activity will be impacted. These impacts should be temporary in duration allowing for reestablishment following dredging activity.

(5) Actions Taken to Minimize Impacts. Hopper dredging will be conducted during the approved "window" of December 1 to March 31 (or whatever the window may be at the time of dredging) to avoid impacting sea turtles. As an alternative, a new drag head has been developed by the Army Corps of Engineers, Waterways Experiment Station which acts as a turtle excluder. This device may be used if agreement is reached by environmental resource agencies and if applicable at the time. Monitoring of the return water from the upland disposal areas will be conducted in order to minimize the discharge concentrations of total suspended solids (TSS) and other parameters as per a 1989 agreement with SC Department of Health and Environmental Control (SCDHEC).

b. Water Circulation, Fluctuation and Salinity Determinations.

(1) Water. Temporary impacts related to dredging and the return water from upland disposal area would be expected; however, permanent impacts to the aquatic ecosystem are not anticipated or expected.

a. Salinity. Impacts to the salinity gradient with particular reference to industries located along the Cooper River were addressed through a study conducted by the Army Corps of Engineers, Waterways Experiment Station, (ACOE-WES). The study indicated that no change in the salinity gradient was expected. Additionally, impacts to the salinity concentrations in the harbor are not expected.

b. Water Chemistry. Temporary changes to water chemistry in the vicinity of dredging/disposal may occur. These changes should be no different than those occurring during maintenance dredging and are considered minimal and temporary in nature.

c. Clarity. Water clarity may be reduced at project depths where dredging is occurring or at the outfall pipe of the upland disposal; however, reduced clarity within the total water column would not be expected. Again, the changes in clarity should be no different than those occurring during maintenance dredging activity.

d. Color. Not applicable.

e. Odor. Not applicable.

f. Taste. Not applicable.

g. Dissolved Gas Levels. A temporary, minor decrease in dissolved oxygen may occur at the dredging location project depth related to suspension of bottom sediments during dredging activity. Any impacts should quickly return to normal following dredging activity. Dissolved oxygen levels at the outfall pipes of upland disposal areas is usually higher due to the turbulence associated with the outfall structures.

(h) Nutrient Levels. Nutrient levels may temporarily increase at the dredging location project depth due to increased turbidity which may result in a release of nutrients from the disturbed sediments. Increased levels would be temporary in nature, returning to normal following dredging.

(i) Eutrophication. Not applicable.

(2) Current Patterns and Circulation.

(a) Current Patterns and Flow. Studies by ACOE-WES have been conducted to determine the optimum channel locations to minimize sedimentation rates. Some changes in current patterns are expected in relation to the realignment of the channel; however, these changes are not expected to have significant environmental effects. Furthermore, if sedimentation rates can be minimized, the frequency of maintenance dredging in the harbor may be reduced also, thereby further lessening impacts from dredging. It should also be noted that if a new State Ports Authority terminal is constructed at the proposed location on Daniel Island, an additional contraction dike is proposed for construction on the west side of the Cooper River just north of Shipyard River. The two existing contraction dikes on the west side of the Cooper River will be refurbished, and the existing contraction dike on the east side of the Cooper River will be removed.

(b) Velocity. As the channel is straightened, velocities may increase in the channel where the realignment is made; however, these changes are not expected to have a significant environmental effect.

(c) Stratification and Hydrologic Regime. No changes are anticipated.

(3) Normal Water Level Fluctuations. Not applicable.

(4) Salinity Gradients. Effects on salinity gradients are addressed in Section II.b.(1)(a) of this document.

(5) Actions That Will Be Taken to Minimize Impacts.

Contraction dikes will assist in maintaining present currents near Daniel Island if the proposed terminal is constructed. The only other location where currents are expected to change is at Horse Reach and Shutes/Folly Reach where realignment of the channel will be made. None of these changes in the present project are expected to cause significant environmental impacts.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site. The return water from the disposal areas would be the only source of turbidity in the vicinity of the disposal site. Provided that the sites are operated as designed, there may be minor increases in TSS levels at the outfall but no permanent impacts are anticipated or expected.

(2) Effects on Chemical and Physical Properties of the Water Column.

(a) Light Penetration. No impact on light penetration is expected at the dredging site. A possible short-term decrease in light penetration resulting from a temporary increase in localized turbidity at the outfall pipes from the disposal areas may occur.

(b) Dissolved Oxygen. DO concentrations in the return water are usually 4.0 mg/l or higher depending on the season due to the turbulence associated with the outfall structures.

(c) Toxic Metals and Organics. Toxic metals and organics are not expected to be found in the new work material due to the depth and the type of material present. Cooper Marl and Coquina would not have toxic levels of contaminants. Initial testing addressing the return water has been conducted. Contaminant levels were not at toxic levels. Additional testing is scheduled to determine sediment contaminant levels and to conduct bioassay testing.

(d) Pathogens. Not applicable.

(e) Aesthetics. Aesthetic impacts are not expected at the disposal areas. The dredging site impacts would be limited to the visual impact of the dredge and the floating pipeline. These impacts would not be any different than those occurring during regular maintenance dredging.

(3) Effects on Biota

(a) Primary Production, Photosynthesis. There should not be a disruption in primary production, photosynthesis at the dredging site or the disposal site.

(b) Suspension, Filter Feeders. Organisms at the dredging site will be impacted. Following dredging, a rapid recovery is expected.

(c) Sight Feeders. A minimal, temporary disruption with rapid recovery is possible. Most sight feeders are transient and can relocate until dredging operations are complete.

(4) Actions Taken to Minimize Impacts. Impacts associated with the actual dredging operation of the hopper or hydraulic dredge are minimal and it is unlikely that further minimization is possible. Clamshell dredging usually creates more turbidity than hopper or hydraulic dredging, not only due to the actual dredging, but also due to overflow from the scow. Depending on the type of material being dredged and the location of the dredging, overflow may be reduced or eliminated to minimize the turbidity levels. Impacts at the ODMDS will be minimized by placing suitable hard material on the L-shaped berm that prevents fine material from drifting onto the live bottoms located to the west of the ODMDS. Impacts associated with the return water from upland disposal areas will be minimized by operation of the disposal area and by monitoring and inspections by COE personnel as discussed in part II.a.5.

d. Contaminant Determinations. Availability of contaminants is discussed in part II.c.(2)(c) of this document. Furthermore, there are specific locations addressed in the public notice for this project identifying where the navigation channel will be relocated. These new work areas have not been dredged and recent depositions may prove to have higher level of contaminants than areas of the channel that are dredged on a regular maintenance schedule. Sediment testing and bioassays will be conducted in January 1995 to determine the suitability of the material for ocean disposal. If unsuitable, this material will be placed in an upland disposal area and monitored during the dredging activity.

e. Aquatic Ecosystem and Organism Determinations.

(1) Effects on Plankton. Any effects on planktonic growth will be dependent on the concentration of turbidity resulting from the dredging and disposal operations. Any effects would be minimal and temporary in duration and would not result in unacceptable adverse impacts.

(2) Effects on Benthos. Any benthic activity at the dredging site (navigation channel) would be interrupted. Benthic activity at the ODMDS may be

impacted depending on the quantity, placement and duration of the discharges. This is a dispersive site, so the fine material that is placed there migrates elsewhere following dredging.

(3) Effects on Nekton. Effects on nekton are not expected. Free swimming organisms that do not rely on currents for their movement can move out of the way of the dredge or material disposal. As discussed earlier in part II.a.(5) above hopper dredging will be conducted during the "dredging window" or turtle deflectors will be utilized.

(4) Effects on the Aquatic Food Web. Temporary, localized effects may occur in the vicinity of the dredging and disposal activity. Effects would be related to sedimentation/turbidity and would rapidly return to normal following completion of the construction activity.

(5) Effects on Special Aquatic Sites. Not applicable.

(6) Threatened and Endangered Species. Impacts to sea turtles and Right Whales are possible; however, they are unlikely due to techniques utilized to minimize/eliminate these impacts. These techniques are discussed in parts II.a.(5) and II.e.(3) above and part II.e.(8) below.

(7) Other Wildlife. Impacts would be related to turbidity and are addressed above.

(8) Actions Taken to Minimize Impacts. Techniques to minimize/eliminate impacts to sea turtles are discussed in part II.a.(5) and part II.e.(3) above. Additionally, individuals are required to be present on the hopper dredges to watch for and prevent impact with Right Whales. Techniques to minimize turbidity include proper management and inspections of the upland disposal area, and monitoring of the return water.

f. Proposed Disposal Site Determinations.

(1) Mixing Zone Determinations. Not applicable.

(2) Determination of Compliance with Applicable Water Quality Standards. The Cooper River and Charleston Harbor Water Quality Classification is SB meaning that these are "tidal saltwaters suitable for primary and secondary contact recreation, crabbing and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption. Also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora." The Wando River is classified as SA waters which are "tidal saltwaters suitable for primary and secondary contact recreation. Suitable also for uses listed above for Class SB waters



with the same exception." No conflict with applicable water quality standards is anticipated.

(3) Potential Effects on Human Use Characteristics.

- (a) Municipal and Private Water Supply. Not applicable.
- (b) Recreational and Commercial Fisheries. Not applicable.
- (c) Water Related Recreation. Not applicable.

(d) Aesthetics. Not applicable.

(e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves. Not applicable.

g. Determination of Secondary and Cumulative Effects on the Aquatic Ecosystem. Effects from the deepening project should be no different than those associated with the general operation and maintenance dredging of the harbor which are minimal and do not result in long term impacts.

III. Findings of Compliance With the Restrictions on Discharge.

a. No significant adaptations of the guidelines were made relative to this evaluation.

b. Alternative disposal sites are limited due to the quantity of material that will be dredged. The six existing disposal sites which may be used for this deepening project include the Charleston ODMDS, Clouter Creek Disposal Area, Daniel Island Disposal Area (if easement is still in place), Morris Island, the Naval Weapons Station Disposal Area, and Drum Island Disposal Area. Disposal locations will be related to the location of the dredging operation, the quality and the quantity of material. Realignment alternatives have been subject to studies conducted by ACOE-WES. The chosen alternative for realignment will straighten out the bend near Horse Reach and Shutes/Folly Reach thereby improving navigation by reducing the hazards of a sharp turn in the channel. The final depth of the project is expected to be 42 feet with two feet of advance maintenance and two feet of allowable overdepth. This is based on the present economic review. It is possible that the project may be deepened to 45 feet with the 4 feet of advance maintenance and allowable overdepth. However, this will be based on the completed economic review. One other alternative is "no action". Under a "no action" alternative, shipping traffic and navigation would continue as it is now. However, as stated in part I.c. of this evaluation, the authority and purpose of the study is to review the project to see if modifications are advisable. The study has determined that modifications are advisable in order to improve navigation for shipping traffic. Providing that there are no significant environmental impacts identified and associated with deepening/widening/realignment, the project is expected to go to construction phase.

- c. The proposed deepening project described in this evaluation would not cause contribute to violations of any known applicable state water standard.
- d. The proposed project will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.
- e. The proposed project will not violate the Endangered Species Act of 1973.
- f. The proposed project will not violate any specified protection measures for marine sanctuaries designated by the Marine Protection, Research, and Sanctuaries Act of 1972.
- g. The proposed disposal of dredged material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values will not occur.
- h. Appropriate steps to minimize potential adverse impacts of the discharge on aquatic systems include proper management of the disposal areas, inspections and monitoring of the return water. Additionally, a location for the disposal of material being placed at the Charleston ODMDS will be specified in contracts and the placement monitored.
- i. The proposed project will not cause unacceptable adverse impacts to any significant historic sites.
- j. On the basis of the guidelines, the proposed disposal sites for the discharge of dredged material are specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.

20 Jan 95  
DATE

  
GEORGE H. HAZEL  
Lieutenant Colonel, EN  
Commanding

Amendment  
404(b)(1) Evaluation

Charleston Harbor Deepening Project  
Charleston, South Carolina

This amendment addresses changes and additions to the Charleston Harbor Deepening Project as described in the 404(b)(1) Evaluation dated 20 January 1995.

I. General Description. The proposed project consists of deepening Charleston Harbor from 40 feet to 45 feet below mean low water (MLW) with two feet of advance maintenance and two feet of allowable overdepth. Furthermore, the project will also include realignment of the channel at Horse Reach and Shutes/Folly Reach to improve navigation by straightening the channel. The navigation channel will be 47 feet deep and 800 feet in width from the 47-foot ocean contour to station 0+00 inside the jetties. The channel will slope upward to 45 feet and remain at 800 feet wide to a point adjacent to Sullivan's Island where it will narrow to 600 feet wide. The remainder of the navigation channel will remain at the present 500 to 800 feet wide with the following exceptions. The Daniel Island Reach will vary from approximately 600 feet to 875 feet in width for the proposed terminal access and include a turning basin approximately 1200 feet in length. Upper Town Creek will be reduced to 16 feet deep and 250 feet wide. The entrance channel will not be deepened in any area where the present depth is already at 47 feet. In addition, two existing contraction dikes located on the west side of the Cooper River, across from the proposed Daniel Island Terminal (Terminal X) will be refurbished. The existing contraction dike located at Daniel Island will be removed, and a new 700 foot long contraction dike, located approximately 150 feet upstream of the degaussing pier on the west side of the Cooper River, will be constructed. In addition, the degaussing line will be removed prior to deepening and relaid following deepening of the channel. Lastly, a turning basin is proposed for construction on the west side of the Cooper River directly across from the proposed Terminal X, (see Figure 1).

II. Suspended Particulate/Turbidity Determinations.

(1) Toxic Metals and Organics. Testing has been completed for the project. Section 401 Water Quality Certification (WQC) and Coastal Consistency for the project were issued on May 2, 1995 and March 10, 1995, respectively, for the entire project with the exception of the Daniel Island Turning Basin and the contraction dikes. Coastal Consistency for these additions to the project was issued February 14, 1996. Water Quality Certification is expected in March 1996. Further, correspondence from EPA approved disposal of material from all sites except material removed from Shipyard River at the Charleston Ocean Dredged Material Disposal Site (ODMDS). Material from Shipyard River must be placed at an upland disposal site.

III. Aquatic Ecosystem and Organism Determinations.

(1) Threatened and Endangered Species. The Atlantic and shortnose sturgeon and manatee are also endangered species which may be affected by the dredging operation. However, measures to provide manatee protection if construction occurs during summer months (June through September) have been included in the project and will be incorporated in the plans and specifications. Further, recommendations provided by the U.S. Fish and Wildlife Service in the Draft Coordination Act Report, 1994 have been responded to in this document and/or have been taken into consideration for planning and contract purposes.

IV. Findings of Compliance with Restrictions on Discharge.


(1) Disposal sites which will be utilized during the deepening project include the Charleston ODMDS and the Clouter Creek Disposal Site.

(2) The final depth of the project is expected to be 45 feet deep with two feet of advanced maintenance and two feet of allowable overdepth.

(3) On the basis of the guidelines, the proposed disposal sites for the discharge of dredged material are specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.

8 Mar 96

DATE

  
THOMAS F. DULICH  
Lieutenant Colonel, EN  
Commanding

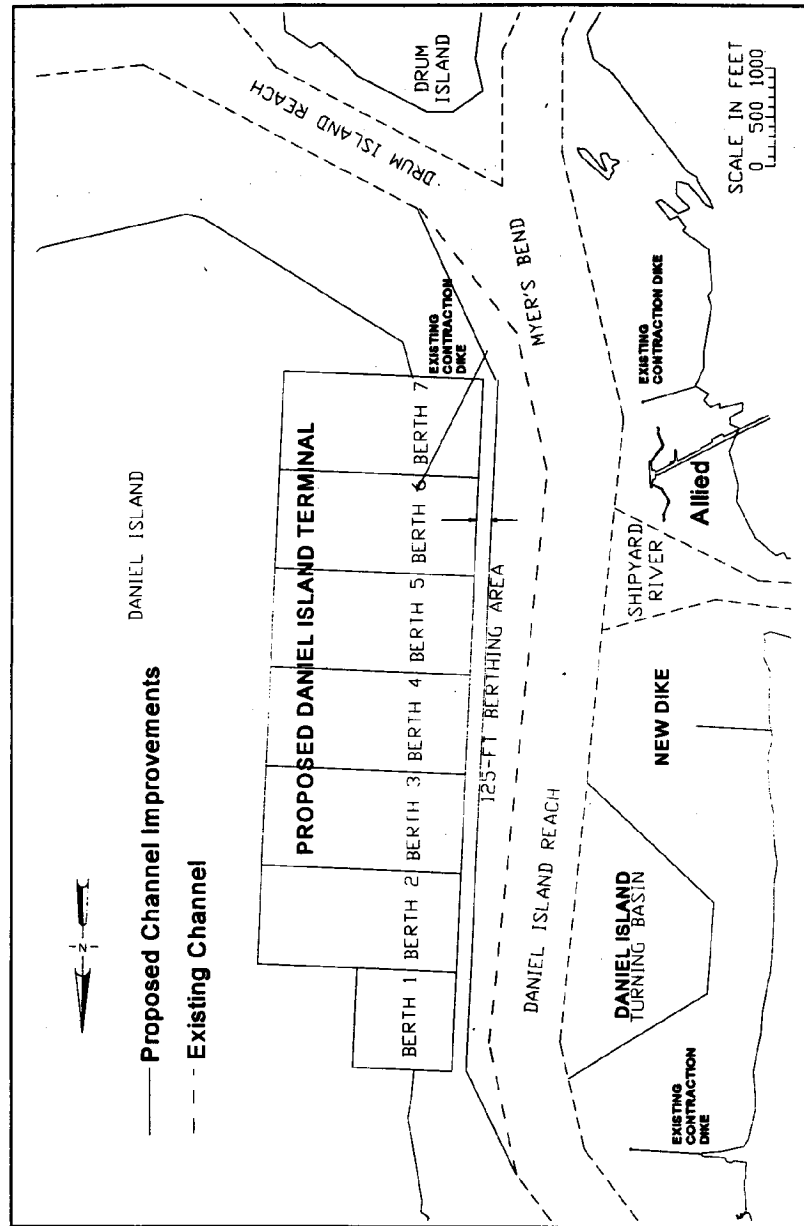


Figure 1: Location of Proposed Improvements

## **APPENDIX B**

### **SECTION 401 JOINT PUBLIC NOTICE**

**JOINT  
PUBLIC NOTICE**

P.O. Box 919  
Charleston, South Carolina 29402-0919  
and

**THE SOUTH CAROLINA DEPARTMENT OF HEALTH  
& ENVIRONMENTAL CONTROL**

**NOTE: THIS IS A CORPS OF ENGINEERS  
CIVIL WORKS PROJECT**

CESAC-EN-PR

9 December 1994

Refer to: P/N 94-1R-498

Charleston Harbor Deepening/Widening Project  
Charleston, South Carolina

The Charleston District, Corps of Engineers, Charleston, South Carolina proposes to perform the work described herein with due consideration and review being given to the relevant provisions of the following laws:

1. The Rivers and Harbors Act of 1899 (33 U.S.C. 403).
2. The Clean Water Act (33 U.S.C. 1251. et. seq.).
3. The Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1531, et. seq.).

The purpose of this notice is to advise all interested parties of dredging activity in Charleston Harbor where dredged material will be placed in diked upland disposal areas and in the Charleston Ocean Dredged Material Disposal Site.

In order to give all interested parties an opportunity to express their views

#### **NOTICE**

is hereby given that written statements regarding the proposed work will be received at this office until

**12 O'CLOCK NOON, MONDAY, 9 JANUARY 1995**

from those interested in the activity and whose interest may be affected by the proposed work.

This public notice addresses the new work (deepening/widening or realigning) of the Charleston Harbor federal navigation channel, the disposal of the dredged material

and diked upland disposal area return waters. It also addresses the results of modified elutriate and column settling tests conducted on sediments collected from

eleven stations in Charleston Harbor. Additionally, it addresses the results of monitoring efforts performed on return waters from two upland disposal areas during the 1994 dredging cycle.

#### **BACKGROUND**

Charleston Harbor is the largest seaport in South Carolina and is ranked as the second largest container port on the East Coast of the United States. The harbor is a natural tidal estuary formed by the confluence of the Cooper, Ashley and Wando Rivers and located approximately midway along the South Carolina coastline, being approximately 140 statute miles southwest of the entrance to Cape Fear River, North Carolina, and 75 statute miles northeast of the Savannah River. The existing Charleston Harbor federal navigation project provides for a 40-foot deep navigational channel, 26.97 miles in length, from the 42-foot ocean contour to the North Charleston Terminal on the Cooper River; a 2.08 mile long 40-foot deep channel in the Wando River extending from the Cooper River to the Wando Terminal; a 38-foot deep channel in Shipyard River Entrance Channel and Turning Basin A; a 30-foot deep channel in Shipyard River Connector Channel and Turning Basin B; and a 40-foot channel in Town Creek.

#### **PROPOSED PROJECT**

The study authority for the feasibility phase of this project is as follows: "Pursuant to Senate and House resolutions adopted on 27 March 1990 and 1 August 1990, respectively (the latter published as House Document Numbered 100-27, 100th Congress, 1st Session), the Charleston District, through the Board of Engineers for Rivers and Harbors, was requested to review the reports of the Chief of Engineers on Charleston Harbor, South Carolina with a view to determining whether any modifications of the project are advisable at this time, with particular view toward deepening and/or widening."

Recommended improvements for Charleston Harbor consist of deepening Charleston Harbor from 40 feet to 42 feet as a minimum depth and 45 feet maximum below mean low water (MLW) with 2 feet of allowable overdepth and 2 feet of advance maintenance.

In addition, the navigation channel will be 800 feet in width beyond the jetties. Within the jetties it will remain 1000 feet wide, reducing to 600 feet wide near Sullivan's Island and remaining at 600 feet in width for the rest of the federal navigation channel, with the exception of the Daniel Island Reach which will vary from approximately 875 feet to 600 feet in width for proposed terminal access. The entrance channel is expected to extend out to the 51-foot ocean contour. Furthermore, the project will also

include realignment of the channel at Horse Reach and Shutes/Folly Reach to improve navigation by straightening the channel.

Modified elutriate tests were conducted with sediment collected from eleven sites in Charleston Harbor. In addition, a column settling test was conducted with sediment composited from the eleven sampling sites. The analytical results from the modified elutriate tests indicate that all concentrations were below detection limits with the exception of silver and arsenic. However, both of these parameters were below the EPA Water Quality Criteria for Chemicals of Concern in Marine Waters, Acute Concentration Levels.

During the deepening project, dredged material will be placed in existing upland disposal areas and at the Charleston Ocean Dredged Material Disposal Site. Potential upland disposal sites include the Clouter Creek Disposal Site, Daniel Island Disposal Site and Morris Island Disposal Site. Sediment chemistry and bioassay testing are planned to determine which material will be suitable for ocean disposal.

Monitoring of the return water from the existing upland disposal areas utilized in Charleston Harbor was conducted during the dredging operation and maintenance activity in 1993 and 1994. On two occasions when it was possible to collect influent samples, the percent removal of total suspended solids exceeded 99.0%. Monitoring information is available at the Charleston District office upon request.

This project is consistent, to the maximum extent practicable, with the South Carolina Coastal Zone Management Program. By this notice, the Charleston District requests concurrence from the South Carolina Department of Health and Environmental Control (SCDHEC) Office of Ocean and Coastal Resource Management (OCRM) that the proposed activity is consistent with the State's Coastal Zone Management Program. Concurrence is conclusively presumed if no state action is received within 45 days of receipt of this notice.

This document serves as a public notice on behalf of the SCDHEC for water quality certification (WQC). A certification is required from the SCDHEC stating that the proposed construction (dredging) and return water from upland contained disposal areas will be conducted in a manner consistent with the Clean Water Act. By this notice, the Charleston District requests SCDHEC to issue that certification. A Section 404(b)(1) Evaluation has been completed and determines that the proposed activity will have no significant adverse effects. The 404(b)(1) Evaluation is available at the Charleston District Office.

Persons wishing to comment or object to State Certification are invited to submit same in writing to the South Carolina Department of Health and Environmental Control, 2600 Bull Street, Columbia, South Carolina 29201, within thirty (30) days of the date of this notice.



Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this application. Requests for a public hearing shall state, with particularity, the reasons for holding a public hearing.

Based on review of available information and evaluation of the proposed activity through the 404(b)(1) procedures, it is determined that the proposed project will not result in significant adverse impacts to the environment.

If there are any questions concerning this public notice, please contact Ms. Robin Collier-Socha of the Environmental Resources Section at telephone number 803/727-4696 or FAX number 803/727-4260.

THOMAS W. WATERS, P.E.  
Chief, Engineering and  
Planning Division

JOINT  
PUBLIC NOTICE  
Charleston District, Corps of Engineers  
P.O. Box 919  
Charleston, South Carolina 29402-0919  
and  
THE SOUTH CAROLINA DEPARTMENT OF HEALTH  
& ENVIRONMENTAL CONTROL

NOTE: THIS IS A CORPS OF ENGINEERS  
CIVIL WORKS PROJECT

CESAC-EN-PR

January 5, 1996

Refer to: P/N 95-1R-406  
Amendment to:  
Charleston Harbor Deepening/Widening Project  
Charleston, South Carolina

The Charleston District, Corps of Engineers, Charleston, South Carolina, proposes an amendment to public notice 94-1R-498 published on December 9, 1994. The amendment includes the work described herein with due consideration and review being given to the relevant provisions of the following laws:

1. The Rivers and Harbors Act of 1899 (33 U.S.C. 401).
2. The Clean Water Act (33 U.S.C. 1251, et. seq.).
3. The Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1531, et. seq.).

The purpose of this notice is to advise all interested parties of additions to the deepening/widening project as described in P/N 94-1R-498. The additions include refurbishment of two existing contraction dikes and construction of a new contraction dike and turning basin. The refurbishment of existing contraction dikes and construction of the proposed contraction dike are necessary to reducing shoaling in the Daniel Island reach by 50 percent. (see Figures 1 & 2).

In order to give all interested parties an opportunity to express their views

NOTICE

is hereby given that written statements regarding the proposed work will be received at this office until

12 O'CLOCK NOON, January 22, 1996

from those interested in the activity and whose interest may be affected by the proposed work.

PROJECT INFORMATION

The existing contraction dikes for refurbishment on the west side of the Cooper River are located downstream of Shipyard River and upstream of the U.S. Navy degaussing pier. The proposed contraction dike will be located approximately 100 to 200 feet upstream of the U.S. Navy degaussing pier, between the two existing contraction dikes.

Marl from the Charleston Harbor Deepening Project will be used to provide a base for the proposed dike. Approximately 30 feet of marl equaling 180,000 cubic yards of material will be placed as a base with a 12 inch foundation blanket equaling 4000 cubic yards of 6" - 12" stone and 3 feet of riprap equaling 12,000 cubic yards. The material will be placed by barge. The dike will be approximately 1000 feet in length, 300 feet of which is vegetated wetlands. (see figures 3, 4 and 5).

The two existing dikes will be repaired by replacing the sheet pile or by placement of rock around the existing dikes. No change in the existing footprint is expected. Again, all work will be conducted by water access.

In addition to the contraction dikes, a turning basin located north of Shipyard River and south of the existing contraction dike (see Figure 2) is proposed for construction. The turning basin will be deepened to the same depth as Charleston Harbor which is 45 feet plus two feet of maintenance and two feet of overdepth for a total depth of 49 feet. Material from the turning basin (3 million cubic yards) will be placed in the Clowder Creek diked disposal area. The total area of benthic impact will be approximately 80 acres. Testing requirements for upland disposal of the material were coordinated with SCDHEC and test results will be submitted to SCDHEC following completion of the testing regime.

#### ADDITIONAL CONSIDERATIONS


This project is consistent, to the maximum extent practicable, with the South Carolina Coastal Zone Management Program. By this notice, the Charleston District requests concurrence from the South Carolina Department of Health and Environmental Control (SCDHEC) Office of Ocean and Coastal Resource Management (OCRM) that the proposed activity is consistent with the State's Coastal Zone Management Program. Concurrence is conclusively presumed if no state action is received within 45 days of receipt of this notice.

The document serves as a public notice on behalf of the SCDHEC for water quality certification (WQC). A certification is required from the SCDHEC stating that the proposed construction, and any return water from upland contained disposal areas will be conducted in a manner consistent with the Clean Water Act. By this notice the Charleston District requests SCDHEC to issue that certification. Persons wishing to comment or object to State Certification are invited to submit same in writing to the South Carolina Department of Health and Environmental Control, 2600 Bull Street, Columbia, South Carolina 29201, within fifteen (15) days of the date of this notice.

Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this application. Requests for a public hearing must state, with particularity, the reasons for holding a public hearing. These requests should be made to SCDHEC at the address listed above.

The Corps of Engineers is soliciting comments from the public; federal, state, and local agencies and officials, and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received will be considered by the Corps of Engineers to determine whether to proceed with the project. Comments are used in the preparation of finalizing the Environmental Assessment pursuant to the National Environmental Policy Act.

If there are any questions concerning this public notice, please contact Mr. Jim Preacher, Chief of the District's Environmental Resources Section (EN-PR) at telephone number: 803/727-4264, FAX number: 803/727-4260.

  
RICHARD M. JACKSON, P.E.  
Chief, Planning Branch

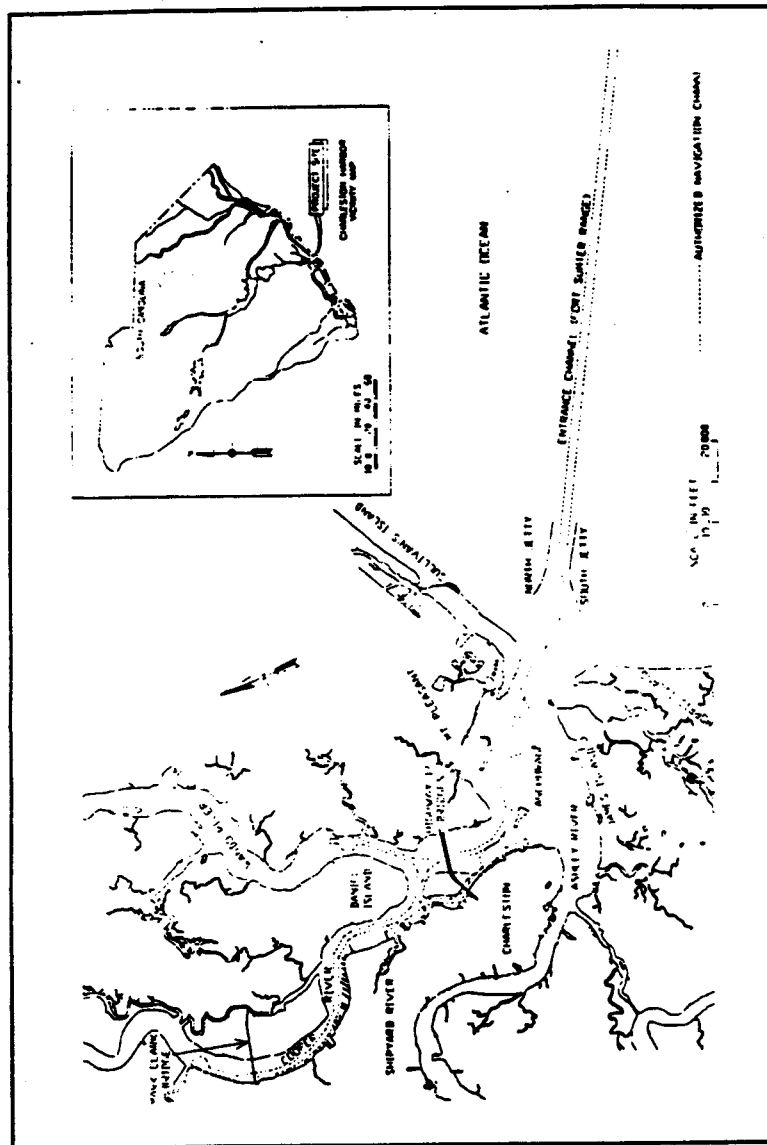


Figure 1. Location and vicinity map

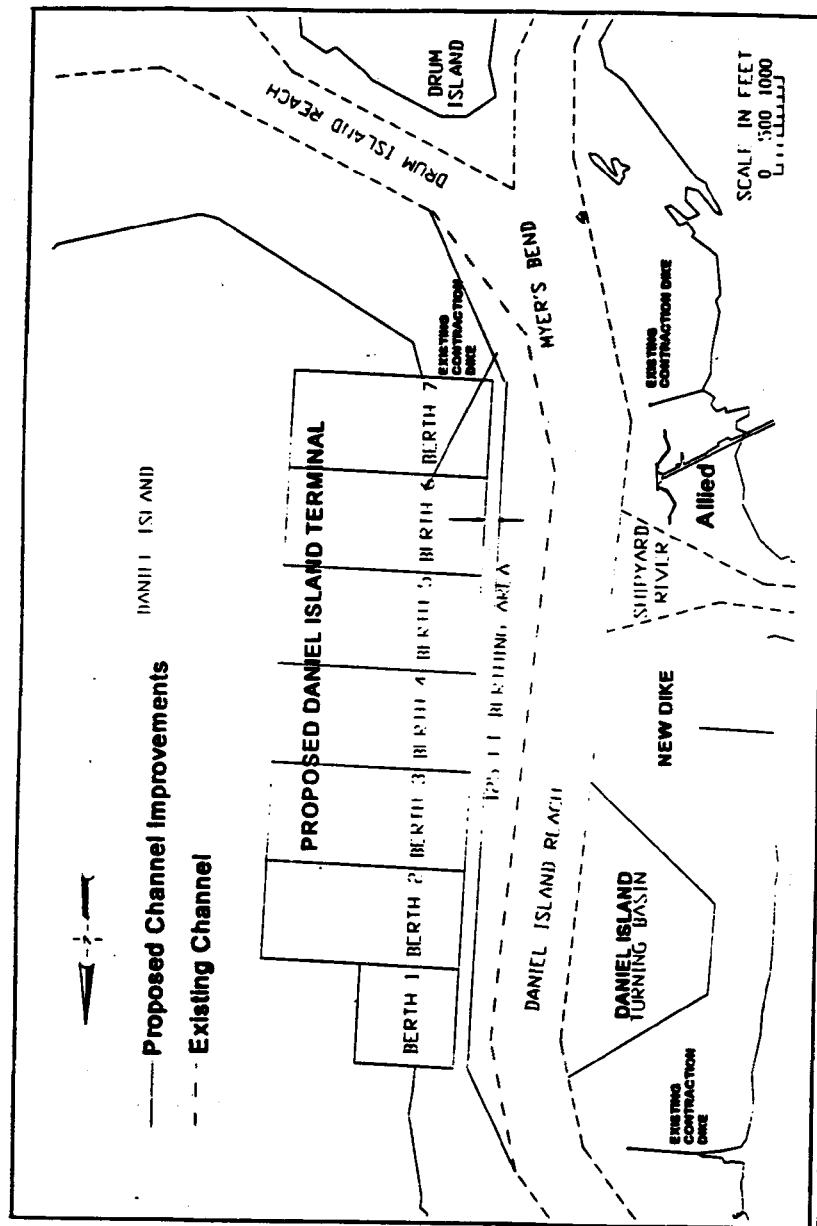
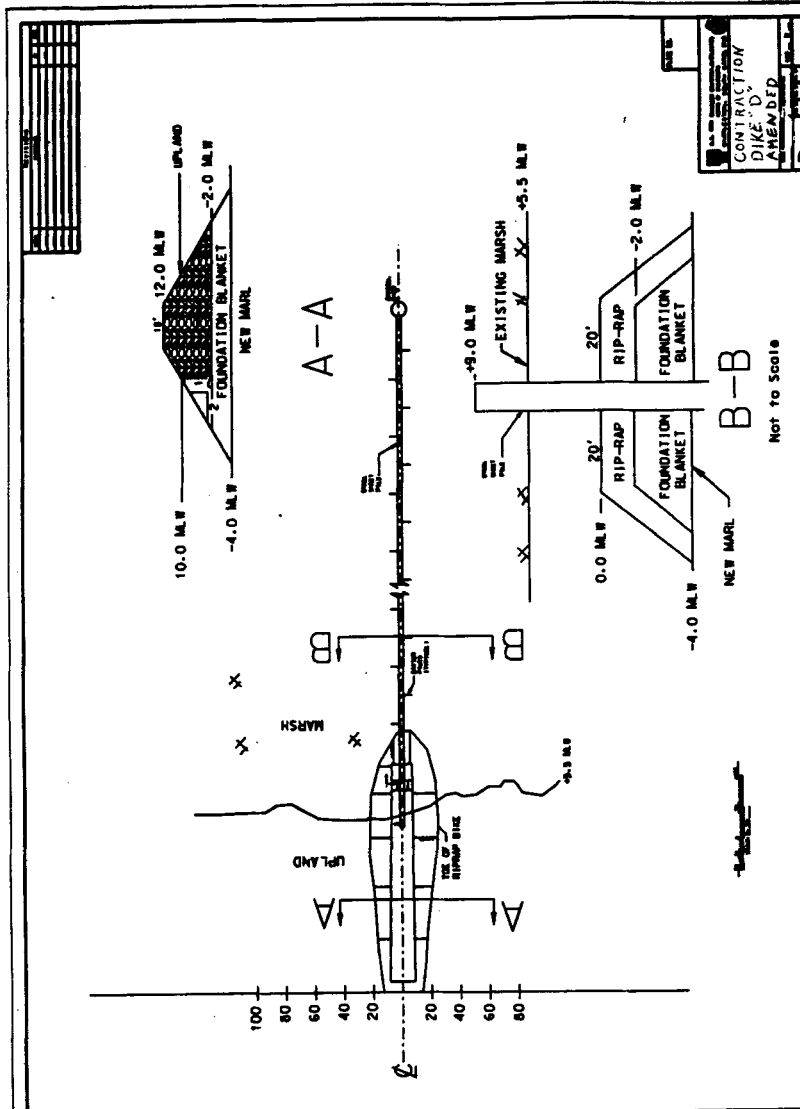


Figure 2: Location of Proposed Improvements





**APPENDIX C**  
**U.S. FISH AND WILDLIFE**  
**FINAL COORDINATION ACT REPORT**



United States Department of the Interior

FISH AND WILDLIFE SERVICE  
P.O. Box 12359  
217 Fort Johnson Road  
Charleston, South Carolina 29422-2359



January 29, 1996

Lt. Colonel Thomas F. Julich  
District Engineer  
U.S. Army Corps of Engineers  
P.O. Box 919  
Charleston, S.C. 29402-0919

Re: Fish and Wildlife Coordination Act Report on the Charleston Harbor Deepening Project

Dear Colonel Julich:

Enclosed please find the above-referenced report submitted in partial fulfillment of Section 2(b) of the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The report is based on the information contained in the October, 1995 Charleston Harbor Draft Feasibility Report with Environmental Assessment and supplemental information provided by Charleston District personnel. The majority of the comments received from the Charleston District on the draft FWCA report have been addressed in this report.

Due to time constraints the report is being forwarded for attachment to the Feasibility Report for Division level review without the comments or concurrence of either the National Marine Fisheries Service or the South Carolina Department of Natural Resources. Coordination with these agencies is ongoing. This report should be modified to incorporate letters of concurrence and/or adoption of recommended changes from these agencies prior to its being considered complete.

Sincerely yours,

Steven S. Gilbert  
Acting Field Supervisor



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## EXECUTIVE SUMMARY

The purpose of this U.S. Army Corps of Engineer's (Corps) study was to determine if any modifications should be made to the currently authorized Charleston Harbor project, with particular emphasis on deepening and widening. The feasibility study evaluates deepening existing channels two to five feet in one foot increment alternatives. It also evaluates channel navigation improvements and improvements to support a new container cargo port terminal on the southwest end of Daniel Island. This fish and wildlife coordination act report evaluates fish and wildlife resources within the Charleston Harbor study area in both current and future scenarios, identifies potential impacts associated with the proposed project and alternatives, and makes recommendations to reduce impacts to fish and wildlife resources.

Charleston Harbor, a natural harbor approximately 14 square miles in area, is formed by the confluence of the Ashley River, Cooper River, and Wando River and lies approximately midway along South Carolina's Atlantic coast. The currently authorized navigation project for Charleston Harbor includes a 42-foot deep entrance channel, a 40-foot deep, 600-foot wide channel in the Cooper River to Goose Creek, and a 40-foot deep, 400-foot wide channel in the Wando River to the Wando terminal.

The Charleston Harbor study area supports significant fish and wildlife resources including marine hard bottom faunal assemblages and estuarine emergent wetlands. Charleston Harbor estuary supports large populations of penaeid shrimp and blue crab which are harvested both commercially and recreationally. Estuarine fish are also abundant in the study area and provide an important recreational harvest.

The juxtaposition of these habitats with major port development causes the potential for significant environmental impacts. Impacts which may result from the proposed project include loss/modification of benthic organisms and habitat at the dredge site, use of capacity at existing disposal sites promoting pressure for the need for new sites, endangered sea turtle mortality caused by hopper dredging in the entrance channel, disruption and/or mortality of immigrating or emigrating aquatic organisms, and direct and secondary habitat alterations resulting from navigational accommodation and construction of new or expanded port facilities and/or related industrial development.

The Service recommends the following measures to reduce the impact of the proposed project on fish and wildlife resources.

1. Review through interagency committee (i.e., Corps, Service, SCDNR, NMFS) the necessity and particulars of a dredging window for the "throat" of the harbor entrance between the jetties. This process should start by utilizing the methodology described in LaSalle (1991) and concentrate on important windows for ingress and egress of key resources such as penaeid shrimp, blue crab, flounder, and red drum.

2. Establish a dredging window for hopper dredge work based on seasonally restricting work to periods when the water temperature is below 16 degrees Celsius. Coordinate with the National Marine Fisheries Service to implement this and any other necessary measures avoiding hopper dredging impacts to endangered sea turtles.
3. Dispose of suitable materials at the ODMDS in accordance with the signed management plan agreement. Also, in accordance with this plan, coordinate with appropriate agencies to plan for detailed monitoring of disposal operations which track the fate of the materials and their ecological effects (especially for large volumes of fine sediments).
4. Develop, in association with water quality agencies and resource agencies, a water quality management/monitoring plan. The plan should address potential harbor deepening water quality impacts, control measures, and monitoring both at the dredge sites and at disposal areas.
5. Avoid deepening any areas for which modeling indicates a high sedimentation rate.
6. Bulk sediment sampling should be conducted in accordance with the Ocean/Inland Testing Manuals for all areas with the exception of those which meet the exclusion criteria based on sediment grain size. The results of all sediment testing including the completed elutriate tests should be provided to the Service for review.
7. Conduct an alternatives analysis for the new contraction dike in the Cooper River. The analysis should, within engineering efficiency constraints, evaluate location, alignment, and construction alternatives consistent with reduction in impact on intertidal habitats, especially those vegetated with emergent marsh.

## **CHARLESTON HARBOR DEEPENING STUDY**

### **FWCA AGENCY COORDINATION**

The following report has been coordinated with the National Marine Fisheries Service (NMFS) and the South Carolina Department of Natural Resources (SCDNR). Letters of concurrence from these agencies are attached as Appendix A. It should be noted that the NMFS letter requests coordination with their Protected Species Branch.

### **INTRODUCTION**

#### **AUTHORITY**

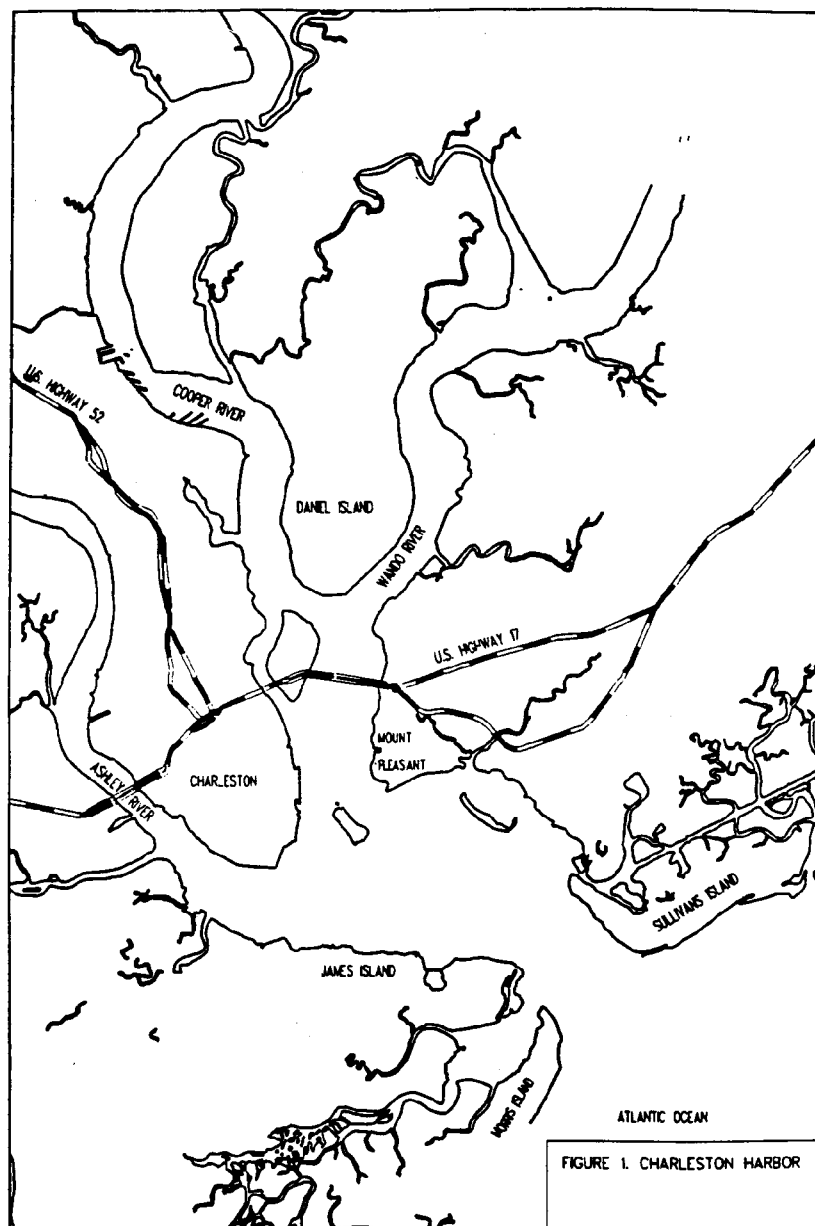
Resolutions by the Senate Committee on the Environment and Public Works adopted March 27, 1990 and the Committee on Public Works and Transportation of the United States House of Representatives adopted August 1, 1990 authorized this U.S. Army Corps of Engineers (Corps) study. The Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) (FWCA) authorizes the U.S. Fish and Wildlife Service's (Service) involvement in this study. The Service prepared this report with funds transferred from the Corps under the National Letter of Agreement between our agencies for funding of FWCA activities.

#### **PURPOSE AND SCOPE**

The purpose of the Corps' study was to determine if any modifications should be made to the existing Charleston Harbor Project, with particular emphasis on deepening and/or widening the channel. This draft FWCA report describes existing fish and wildlife resources within the Charleston Harbor study area, the future of these resources with and without the project, evaluates the selected plan and alternatives, and identifies fish and wildlife conservation measures and recommendations.

#### **PRIOR STUDIES AND REPORTS**

The Service provided a FWCA Report on the currently authorized deepening project (40 foot Channel) in 1980 and a supplemental FWCA report on mitigation alternatives for this project in 1986. In 1982 the Service provided a FWCA Report on Charleston Harbor Wando River extension project. In 1991 the Service provided a FWCA Report on a proposal to deepen Shipyard River from 38 to 40 feet.



River Basin. The project is designed to decrease shoaling in Charleston Harbor caused by construction of the South Carolina Public Service Authority's Santee-Cooper hydroelectric project during the 1940's which diverted water from the Santee River Basin into the Cooper River. Rediversion of this freshwater flow has reduced the post-1940 average discharge of 15,600 cfs to an average discharge of 4,500 cfs at Pinopolis Dam on the Cooper River (Van Dolah et al. 1990).

#### EXISTING NAVIGATION PROJECT

The Water Resources Development Act of 1986 (PL 99-662) (WRDA) authorized the deepening of Charleston Harbor from 35 to 40 feet generally in accordance with the plan recommended in the Chief of Engineers Report dated 27 August 1981. The project as implemented consists of the following:

- a. Deepening Cooper River Channel from 35 to 40 feet (from 35 to 42 feet in the ocean bar and entrance channel) from the 42-foot ocean contour to Goose Creek, a distance of 26.9 miles;
- b. Widening Cooper River Channel to 500 feet between river miles 12.6 and 14.7;
- c. Enlarging turning basin diameter at head of Cooper River to 1,400 feet;
- d. Deepening Town Creek channel to 40 feet;
- e. Enlarging Columbus Street turning basin to 1,400 feet;
- f. Deepening the first tangent and the lower turning basin in Shipyard River from 30 to 38 feet;
- g. Easing a bend in Cooper River Channel at river mile 7.3 by diminishing the inside angle through widening.
- h. Realigning portions of Cooper River Shipyard River and Town Creek Channels to insure 125 feet clearance between pier head lines and edge of channel.

The WRDA also authorized a 40-foot deep, 400-foot wide channel in the Wando River to the South Carolina State Ports Authority terminal. The project also routinely includes two feet of advance maintenance dredging and two feet of overdepth dredging.

The entrance channel is maintained with a hopper dredge and the material is placed in an Ocean Dredged Material Disposal Site (ODMDS). The remaining channels are maintained by hydraulic pipeline dredging and the material is placed in existing diked disposal areas.

## WATER QUALITY

Water quality in the majority of the harbor is rated as SB by the South Carolina Department of Health and Environmental Control (SCDHEC), although some tributaries have ratings of SA and SFH (see Table 1). The SB rating applies to tidal salt water suitable for primary and

Table 1. Water Quality Classifications of Charleston Harbor and its Tributaries to the Point of Salt Water Influence

Waterbody	Classification	Location
Wando River	SFH	From headwaters to a point 2.5 miles N. of confluence with Cooper River
Wando River	SA	From 2.5 miles N. of confluence with Cooper River to confluence with Cooper River
Ashley River	SA	Total salt water influenced portion to Charleston Harbor (although lowered D.O. requirement for portion from Church Creek to Orangegrove Creek
Cooper River	SB	Total salt water influenced portion
Charleston Harbor	SB	From the Battery to the Atlantic Ocean

Class SFH = Shellfish Harvesting Waters - tidal saltwaters protected for shellfish harvesting.

Class SA = tidal waters suitable for primary and secondary contact recreation. Suitable also for uses listed in Class SB with the same exception.

Class SB = tidal saltwaters suitable for primary and secondary contact recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption. Also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora.



secondary contact recreation, crabbing, and fishing, except for the harvesting of clams, mussels, or oysters for market purposes or consumption. These waters are also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora (SCDHEC 1993). Waters rated as SB should not have dissolved oxygen concentrations less than 4 mg/l and fecal coliform concentrations should not exceed a geometric mean of 200 colonies/100 ml based on five consecutive samples taken within a 30 day period. Although these concentrations have been exceeded occasionally, recent reviews of data collected by SCDHEC indicate that water quality within the harbor basin often meets SB standards for dissolved oxygen and fecal coliform levels (Chestnut 1989; Davis and Van Dolah 1990).

The Ashley River and portions of the Wando River have a water quality classification of SA. Although SA waters have the same designated uses as SB waters, the water quality standards are stricter for dissolved oxygen (daily average of not less than 5 mg/l with a low of 4 mg/l, treated wastes, toxic wastes, deleterious substances and colored or other wastes (SCDHEC 1993). Water quality in the Wando River was recently upgraded to SFH above the Wando Terminal. This rating applies to tidal salt waters protected for shellfish harvesting and for uses listed in Class SA and Class SB. SFH water must maintain a daily average dissolved oxygen concentration of 5 mg/l or higher with a low of 4 mg/l and have median coliform concentrations of 14 colonies/100 ml with no more than 10% of the samples exceeding 43 colonies/100 ml (SCDHEC 1993).

#### FISH AND WILDLIFE RESOURCE CONCERNS AND PLANNING OBJECTIVES

In addition to providing significant wetlands and fish and wildlife habitat, Charleston Harbor has a long history of development as a major port. Charleston Harbor is currently a leading container port in the south Atlantic region. Associated with the port are major industrial and commercial facilities.

The juxtaposition of fish and wildlife habitats with major port development causes the potential for significant environmental impacts. Direct impacts of channel dredging and other project features include:

- (1) Loss/modification of benthic organisms and habitat at the dredge site;
- (2) Loss/modification of habitat at the dredged material disposal site;
- (3) Hydraulic modifications which in turn potentially affect circulation patterns, tidal exchange, sedimentation patterns and salinity distribution;
- (4) Water quality degradation at the dredge site and/or the disposal site.

- (5) Endangered sea turtle mortality caused by hopper dredging in the entrance channel.
- (6) Loss of tidal marsh, flats and shallow subtidal habitats associated with construction of the new contraction dike.

Potential secondary impacts (impacts induced by the project) include habitat alterations resulting from construction of new or expanded port facilities. Such impacts may involve dredging and/or filling of tidal marsh, intertidal flats and other estuarine habitats.

Loss of habitat at the dredged material disposal site has historically, and continues to be, one of the most obvious significant impacts of channel development. In Charleston Harbor approximately 6,300 acres of wetland habitat, primarily estuarine emergent habitat, has been lost. Deepening Charleston Harbor will require use of capacity in existing disposal areas including the Charleston ODMDS.

The Charleston ODMDS is one of the most active, frequently used sites in the South Atlantic Bight. Originally, the management plan for ocean dredged materials disposal associated with the Charleston Harbor complex called for two sites. The permanently designated ODMDS was approximately 3 X 1.5 nautical miles in size. This site was designated to receive all dredged material from maintenance dredging in the harbor and entrance channels. Surrounding the permanent ODMDS, was a larger disposal site. This site encompasses an area of approximately 5 X 3 nautical miles, and was designated for one time use in conjunction with the Charleston Harbor 40-foot deepening project.

Based on the above design, monitoring activities began in 1985 to assess the fate and impact of dredged material placed within the ODMDS. Detailed bathymetric monitoring of the ODMDS and surrounding area have generally been conducted annually by the Corps since 1985. The primary objectives of these bathymetric surveys were to: (1) document the location and configuration of mounds created with dredged material, which was placed along narrow corridors within the ODMDS, and (2) determine whether these mounds were stable.

Monitoring of bottom sediment characteristics and biological communities in the area was conducted primarily by the South Carolina Department of Natural Resources (SCDNR) working under contract to the Corps. This latter effort, which was conducted in 1987, focused largely on obtaining baseline data on the structure and composition of benthic communities and sediment characteristics (physical and chemical) in and around the permanently designated ODMDS (Winn et al. 1989). The SCDNR benthic sampling program was designed around the corridor disposal concept with a network of stations positioned to intercept the migration of material over the bottom, if it occurred, and assess changes in the benthic communities or surface sediment characteristics resulting from the movement of dredged material. The 1987 baseline survey detected minor changes in benthic community structure and sediment composition related to a disposal operation completed in 1986, and some movement of the material was detected away from the disposal site (Winn et al., 1989). However, this

movement did not appear to significantly alter sediment composition or benthic communities outside the ODMDS.

In the Fall and Winter of 1989-1990, local fishermen reported that disposal operations occurring in the permanently designated ODMDS were impacting a live bottom area within the western quarter of that area. Until that time, no significant live bottom areas were known to exist within or near either disposal area. Subsequent video mapping of the sea floor conducted by the EPA in the vicinity of the ODMDS confirmed several areas of live bottom within and beyond the boundaries of both sites. As a result of this survey, management strategies were developed to avoid disposal on the mapped live bottom areas. Studies to assess the impact of dredged material re-suspension and disposal plume turbidities on sessile live bottom fauna at one representative site within the ODMDS were initiated.

Based on the above, a Site Management Plan was developed through interagency coordination of the Corps, EPA, the Service, and the SCDNR. The plan was completed and signed by the Corps and the EPA in March of 1993. This plan requires that material suitability for ocean disposal be verified by the Corps and agreed to by EPA, places no seasonal restrictions on use of the site, specifies placement of materials at exact locations based on agreement between EPA and the Corps, and requires electronic verification of placement by dredging contractors as part of monitoring requirements. Fine grained materials are to be placed in the eastern portion of the site while coarse-grained materials not used for other beneficial purposes (i.e., beach nourishment) are to be used to expand a "deflection berm" providing an L-shaped barrier for protection of off-site resources to the south and west of the ODMDS. Since there is a high likelihood that the majority of materials from this project would be placed at the ODMDS, it is important to insure compliance with this management plan.

Ongoing baseline studies within and surrounding the ODMDS continue. Two annual assessments were conducted in 1993 and 1994. These sampled benthic assemblages and sediment characteristics at 200 stations during one intensive summer sampling period. These reports are due to be released shortly.

Although the Corps of Engineers does not have immediate plans to develop any new upland disposal sites, it is logical to assume that at some time in the future a number of other disposal area sites may need to be considered for future deepening and maintenance of Charleston Harbor. In anticipation of the loss of the Daniel Island disposal site due to development of the island, the Charleston Harbor Disposal Area Study funded by the South Carolina Coastal Council evaluated 20 sites in the project area based on environmental and engineering constraints. Results of this study may be used as a tool for initial analysis of any new disposal areas for future maintenance of the Charleston harbor project.

One of the greatest potential impacts of harbor deepening is the hydraulic modification which will result in changes in circulation, sedimentation, and salinity patterns (Allen and Hardy 1980). Increased erosion and/or sedimentation due to changes in circulation patterns may

degrade wetlands and fish/shellfish habitat. Increases in ocean derived sediments introduced into the harbor may lead to increased maintenance dredging and the need for additional dredged material disposal areas in the future. Although there has not been documentation of the sources of sediment deposition in the harbor, nor strong documentation of the success of the Rediversion Project at significantly lowering such deposition, there has been speculation that ocean derived sandy sediments may be contributory to the shoaling rates and hence maintenance dredging burden in Charleston Harbor. Salinity and sediment type are major factors controlling distribution of benthic populations in the Charleston Harbor estuary, although the relationship of these parameters with faunal distribution patterns is not very strong in the lower harbor area encompassed by this project (Van Dolah et al. 1990). Salinity is a major factor influencing plant species composition in tidal marshes (Pearlstone et al. 1990) and availability and distribution of nursery areas. According to a model run by the Corps' Waterways Experiment Station, the project would not result in a change in salinity patterns in the harbor.

At the dredging site, potential water quality impacts include increased turbidity and oxygen demand, and release of contaminants and nutrients - particularly free sulfides, hydrogen sulfide, and ammonia. Good maintenance and dredging practices can limit water quality impacts of pipeline dredging. Overflow from hopper dredges can cause high turbidity levels (Allen and Hardy 1980). At open water disposal sites water quality impacts are similar to the above, but of greater magnitude due to the release of larger amounts of dredged material into the water column.

Dickerson et al. (1991) reported that hopper dredging in several southeastern entrance channels has caused high sea turtle mortalities due to entrainment by the draghead. Van Dolah et al. (1992) concluded, after a 15 month survey of the Charleston Harbor entrance channel, that sea turtle densities were sufficient to warrant concern over mortality from hopper dredging.

The following planning objectives were developed considering the above problems.

1. Avoid impacts to estuarine wetlands in the Charleston Harbor study area.

Estuarine wetlands provide the highest quality fish and wildlife habitat in the Charleston Harbor study area. Harbor development and maintenance have resulted in loss of approximately 6,300 acres of wetlands due to filling and dredged material disposal. Future harbor activities should avoid or minimize the use of these highly valuable habitats.

2. Avoid impacts to marine live bottom habitat in the vicinity of the Charleston ODMS.

Offshore live bottoms provide productive and diverse invertebrate and fish habitat and are important to recreational fisheries. The predominant offshore marine sand bottoms provide

only low value invertebrate and fish habitat. Therefore live bottom habitat needs to be protected.

3. Maintain water quality suitable for management of diverse and productive fish and wildlife populations in Charleston Harbor.

Good water quality is an essential component of productive wetland wildlife habitat. Currently, water quality in most of the study area is suitable for most fish and wildlife purposes. Proper planning needs to ensure that harbor development would not degrade water quality.

4. Avoid hopper dredging impacts to endangered sea turtles.

Available information indicates that hopper dredging in the Charleston Harbor entrance channel could cause substantial sea turtle mortality. Measures need to be implemented to avoid impacts to these endangered species. These measures should include state of the art avoidance measures such as those currently in use by the Charleston District in cooperation with the National Marine Fisheries Service including use of the new draghead designed for this purpose and limiting the temporal window for dredging to periods to those outside of the turtle's presence.

5. Avoid design alternatives which would inordinately increase the need for future maintenance dredging.

Increased maintenance dredging increases disturbances to benthic communities and water quality. It also puts pressure on the limited disposal space available.

## EXISTING FISH AND WILDLIFE RESOURCES

### AQUATIC SYSTEMS

Aquatic systems in the study area provide high value fish and wildlife habitat. Marine and estuarine wetland systems as described by Cowardin et al. (1979) are common in the study area.

#### Marine System

The near shore ocean community, which delimits the eastern boundary of the study area may be classified as marine, subtidal, unconsolidated bottom habitat (Cowardin et al. 1979). This community is comprised of surf zone, a shallow inshore water region, and a deep-water offshore area. Bottom sediments, which are predominantly sand, provide low value fish

habitat (Barans and Burrell 1976). Vascular plants are absent from the near shore community, although phytoplankton and seaweeds are present where sufficient light penetration and suitable substrate occur.

Widely scattered outcrops of rock, relict worm tube reefs, and other materials provide vertical relief and attachment sites for sessile benthic invertebrates. The physical cover and sessile invertebrates attract motile invertebrates and fish. These "live bottoms" are rich in abundance and diversity of invertebrates and fish and are important to the recreational marine fishery (Sandifer et al. 1980).

The ocean beach (to the high water line), sand bars, and sand flats in the study area are classified as marine, intertidal, unconsolidated shore (Cowardin et al. 1979). These intertidal beaches, sand bars, and flats experience almost continuous changes as they are exposed to erosion and deposition by winds, waves, and currents. Sediments are unstable and vegetation is absent. Wave action, long shore currents, shifting sands, tidal rise and fall, heavy predation, and extreme temperature and salinity fluctuations combine to create a rigorous environment for macroinvertebrates, the predominant fauna.

Zooplankton, benthic invertebrates, fishes, birds, mammals, and reptiles are all important faunal components of the marine system. Important game fishes in inshore waters include spot, croaker, flounder, spotted seatrout, sheepshead, bluefish, southern kingfish, black drum, and red drum. Some of the world's most popular big gamefish are found in deeper offshore waters, including king mackerel, wahoo, dolphin, blue and white marlin, swordfish, and sailfish. Numerous shorebirds and wading birds utilize the study area's marine habitats. Aquatic mammals, including various whale and dolphin species, occur in the marine waters.

#### Estuarine Systems

The estuarine system consists of open water tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have access (either open, partly obstructed, or sporadic) to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from land.

Brackish and salt marshes of the study area are classified within the estuarine system, as are mud flats, oyster reefs, stream beds, and shorelines. Classes of the estuarine system present include emergent wetlands, unconsolidated bottom, stream bed, unconsolidated shore, and reef.

Intertidal, emergent wetlands are the most conspicuous class of the estuarine system in the study area. These include salt and brackish water marshes. The low salt marsh is regularly flooded by daily tides and extends from about mean sea level to the mean high water (MHW) level. Low salt marsh is monospecific, being vegetated with smooth cordgrass. The high marsh occurs above MHW, is flooded irregularly by spring and storm tides, and has a varied

plant composition. Halophytes occurring in abundance include black needlerush, saltmeadow cordgrass, saltgrass, sea ox-eye, glasswort, saltwort, sea lavender, and marsh aster.''

Brackish water marshes represent a transition zone between salt marshes and tidal freshwater marshes. Plant species found in the more seaward brackish marshes are quite similar to those of the upper high marsh zone of the salt marsh. Pure stands of black needlerush may occur in these marshes. Saltmarsh bulrush, aster, marsh elder, sea-myrtle, panic grass, saltmeadow cordgrass, sea ox-eye, broomsedge, and seaside goldenrod also may be present. Giant cordgrass occasionally appears along upland borders of the more seaward brackish marshes. As salinity decreases, giant cordgrass generally replaces needlerush as the dominant plant.

These emergent wetlands are highly productive natural systems that provide spawning, nursery, and feeding habitat for important commercial and sport fishes. An estimated 95 percent of all commercial finfish and shellfish and most marine sport fishes inhabit estuarine areas during all or part of their life cycles. Estuarine emergent marshes also provide valuable habitat for various waterfowl and other wildlife species, including wading birds, shorebirds, and mammals such as the marsh rabbit, marsh rice rat, river otter and mink

Estuarine intertidal shorelines, sand bars, and mud flats are classified as intertidal, unconsolidated shore (Cowardin et al. 1979); these are typically grouped together as intertidal flats. Peterson and Peterson (1979) define intertidal flats as those portions of the unvegetated bottom of sounds, lagoons, estuaries, and river mouths which lie between the high and low tide marks. These areas occur along shorelines of islands and of the mainland and as emergent bottoms in areas unconnected to dry land. Intertidal flats are composed of sandy and muddy sediments in a wide range of relative proportions. Intertidal flats also provide valuable habitat for benthic invertebrates which are heavily preyed on by fish, wading birds, and shorebirds. Over 50 species of fish live and feed on intertidal flats during high tide. As many as 16 species of fish are, at least in part, dependent on prey which lives or forages on the flats (Peterson and Peterson 1979). These areas are also extremely important feeding areas for wading birds and shorebirds.

Estuarine, intertidal, reef habitat is represented primarily by oyster reefs occurring in estuarine intertidal zones. The American oyster can tolerate a wide range of salinity, temperature, turbidity, and oxygen tension and is therefore adapted to the periodic changes in water quality that characterize estuaries. Oysters often build massive, discrete reefs in the intertidal zone. Oyster reefs occur throughout the project area but are closed for recreational and commercial harvest due to unacceptable water quality. Water quality in the Wando River upstream of the Wando terminal is suitable for shellfish harvest. Closed oyster reefs still perform a variety of ecological functions in support of the estuarine system. These include stabilization of erosional processes, modification of long-term changes in tidal stream flow and overall marsh

physiography, mineralization of organic carbon and release of nitrogen and phosphorus in usable forms, and provision of stable islands of hard substrate in otherwise unstable environments. This latter function is particularly important from an estuarine habitat perspective (Bahr et al. 1981).

#### FISH AND SHELLFISH

Fishery resources within Charleston Harbor and the project area consist of numerous estuarine and marine species. Demersal fish species which are typically associated with the lower water column and substrate of Charleston Harbor include star drum, croaker, bay anchovy, Atlantic menhaden, spotted hake, weakfish, spot, blackcheek tonguefish, white catfish, and silver perch (Van Dolah et al. 1990, Shealy et al. 1974). Other fish species which are of commercial or recreational value and are commonly found within Charleston Harbor include flounder, red drum, spotted seatrout, bluefish, Atlantic croaker, spot and black drum. Life histories and population dynamics of several of these species was recently investigated in the Charleston Harbor estuary and other State waters (Wenner et al. 1990).

Four anadromous fish species, American shad, blueback herring, hickory shad, and striped bass, and one catadromous species, American eel utilize Charleston Harbor and its tributaries as migration routes and spawning areas. The shortnose sturgeon, an endangered species, has been documented as rarely occurring within Charleston Harbor (Van Dolah et al. 1990).

Fishes which commonly reside within the intertidal marshes of the project area include mummichog, sheepshead minnow, Atlantic silverside, and bay anchovy. Other species which frequent intertidal marshes include both species of mullet and several species of Sciaenids. Tidal pools in the high marsh areas are inhabited by species such as sailfin molly and mosquitofish.

Charleston Harbor estuary supports large populations of penaeid shrimp and blue crab which are harvested both commercially and recreationally. The shrimp fishery is South Carolina's largest commercial fishery, averaging 3.24 million pounds (11.8 million dollars) annually during recent years. The Charleston Harbor estuary contributed approximately 20% of the state's total 1978-1987 shrimp landings. Annual commercial landings of blue crab averaged 6.17 million pounds (1.7 million dollars) during recent years, with Charleston Harbor accounting for about 8% of the statewide total (Van Dolah et al. 1990). Charleston harbor also supports one of the state's highest utilized estuaries for recreational bait shrimping representing 43, 44, and 45 percent of statewide recreational shrimping use for 1988, 1989, and 1990, respectively (Joe Carson, SCDNR, personal communication). If these percentages are applied to the 13,366 issued licenses for 1994, the importance of this area for recreational use is impressive.



## ENDANGERED SPECIES

The Charleston Harbor study area supports a number of endangered and threatened species (Table 2). Maintenance and enhancement of habitat for endangered and threatened species is an important Service goal. The species listed in Table 2 should be taken into consideration during the alternatives analysis for this project including potential needs for future new disposal sites.

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Table 2. Federal Endangered (E), and Threatened (T), Species Occurring In Charleston County, South Carolina.

West Indian manatee (*Trichechus manatus*) - E  
Bald eagle (*Haliaeetus leucocephalus*) - E  
Bachman's warbler (*Vermivora bachmanii*) - E  
Wood stork (*Mycteria americana*) - E  
Red-cockaded woodpecker (*Picoides borealis*) - E  
Arctic peregrine falcon (*Falco peregrinus tundrius*) - T  
Piping plover (*Charadrius melodus*) - T  
Kemp's ridley sea turtle (*Lepidochelys kempii*) - E  
Loggerhead sea turtle (*Caretta caretta*) - T  
Leatherback sea turtle (*Dermochelys coriacea*) - E  
Green sea turtle (*Chelonia mydas*) - T  
Shortnose sturgeon (*Acipenser brevirostrum*) - E  
Canby's dropwort (*Oxypolis canbyi*) - E  
Chaff-seed (*Schwalbea americana*) - E  
Pondberry (*Lindera melissifolia*) - E  
Sea-beach pigweed (*Amaranthus pumilus*) - T

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## **FUTURE OF FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT**

Threats to the above-described fish and wildlife resources of the Charleston Harbor area are primarily related to continued growth and development of the surrounding areas. Charleston's population is projected to increase by more than 50% from 500,000 to almost 800,000 over the next twenty years (Charleston Harbor Project, 1994). Direct loss of valuable aquatic and aquatic-related habitats from commercial and residential developments are not anticipated to be cumulatively significant due to in-place regulatory mechanisms and a public awareness of the value of these systems. However, increased population size is directly associated with increasing nutrient loads by increasing the demand for sewage treatment, industrial discharges, and stormwater runoff. The Charleston Harbor Project, funded by the National Oceanographic and Atmospheric Administration's Office of Coastal Resource Management through a Special Area Management Plan managed by the South Carolina Office of Ocean and Coastal Resource Management, has identified eutrophication as the most serious potential threat to the sustained health of the Charleston Harbor estuary (Charleston Harbor Project, 1994).

Such eutrophication could cause changes in dissolved oxygen levels and other water quality characteristics. This in turn could result in shifts in estuarine community structure affecting primary nursery areas and important feeding areas for many recreationally and commercially important species. Such trends could be controlled through careful planning, controlled growth, and control of both point and non-point discharges.

## **SELECTED PLAN AND ALTERNATIVES**

As described in the Draft Feasibility Report for this project, the selected plan consists of deepening Charleston Harbor from 40 feet to 42 feet (minimum) or 45 feet (maximum) below mean low water with 2 feet of allowable overdepth and 2 feet of advance maintenance dredging (except for the entrance channel).

The navigation channel would be 800 feet in width seaward of the jetties and slope out to the 47 foot ocean contour. The channel would widen to 1000 feet just outside the jetties and return to an 800 foot width within the jetties, reducing further to 600 feet in width near Sullivan's Island. The width would remain at 600 feet for the rest of the federal navigation channel with the exception of the Daniel Island Reach which would vary from approximately 600 feet to 875 feet in width for proposed terminal access and the Horse and Shutes/Folly Reach where realignment to straighten the channel would result in a 900 to 1000 foot wide channel.

Dredged material from the deepening would be placed in existing upland disposal areas and at the Charleston ODMDS. Potential upland disposal sites include the Clouter Creek Disposal Site, the Daniel Island Disposal Site, the Navy Weapons Station Disposal site, the Drum Island Disposal Site and the Morris Island Disposal Site (see figure 2). Sediment chemistry and bioassay testing are planned to determine which material would be suitable for ocean disposal.

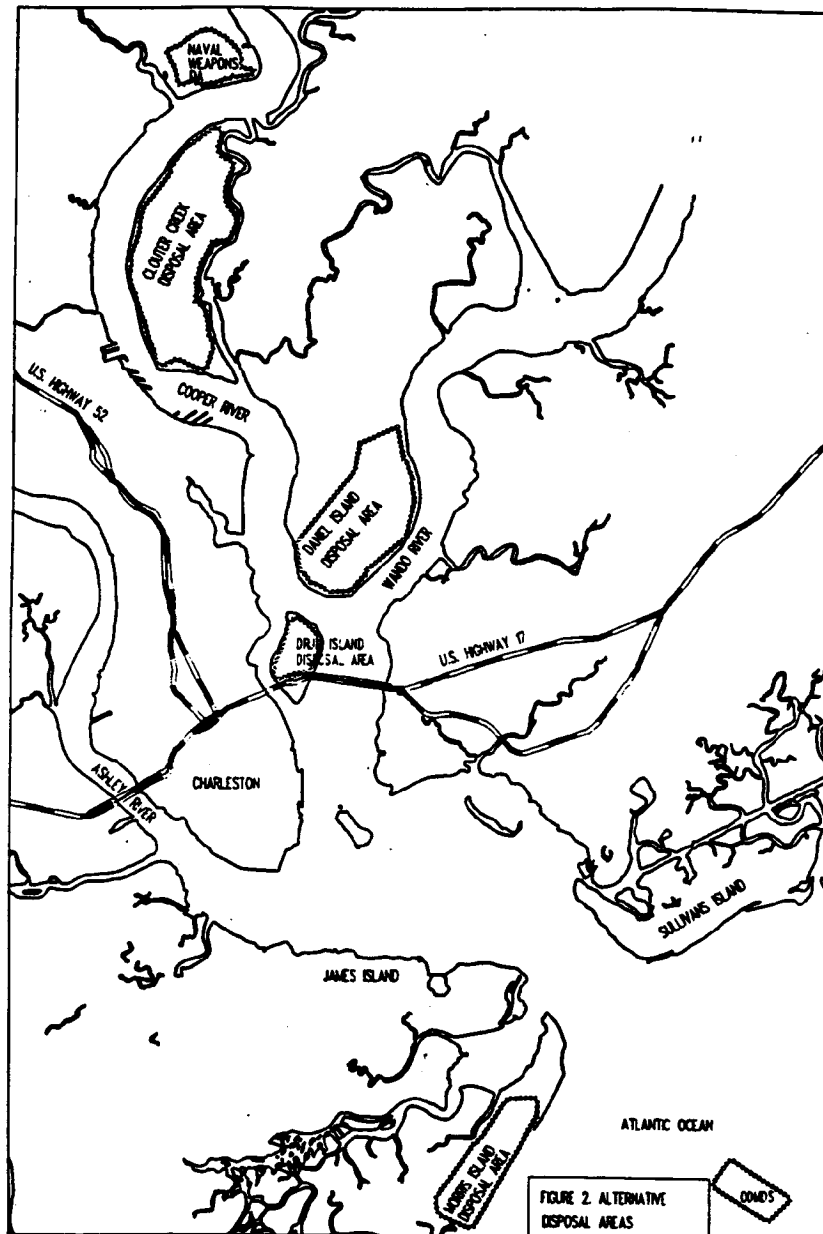
Project modifications which are proposed specifically to accommodate a new port facility at the southwest end of Daniel Island include: (1) construction of a 1000 foot long sheet pile contraction dike; (2) repairing two existing contraction dikes within their original footprint; (3) constructing an approximately 80 acre, 49 foot deep turning basin in subtidal bottoms; and (4) placement of approximately 3 million cubic yards of dredged material in the Clouter Island diked disposal area. As currently proposed, the new contraction dike would involve excavation of an 80 foot (bottom width) by -10 foot (MLW) canal through 300 feet of marsh, backfilling the excavated area with marl "crush and run" and rip-rap, constructing the sheet pile wall into the stone base, and restoring the excavated area to grade with excavated marsh materials.

Alternatives appear to be limited. A "no action" option would maintain the harbor at its previously authorized design depth of 40 feet plus 2 feet of allowable overdepth and 2 feet of advance maintenance (2+2). Depth options of 42 feet (and 2+2) to 45 feet (and 2+2) at one foot increments represent the primary alternatives considered with the exception of alternatives for material disposal. As described above these latter alternatives are limited to use of existing upland sites and/or the Charleston ODMDS. Some alternatives for the new contraction dike have been considered. As originally presented in the draft feasibility report, the contraction dike through marsh habitat was proposed as a solid fill marl causeway. Alternatives for location of the new terminal facility are not addressed in the study.

## DESCRIPTION OF POTENTIAL IMPACTS

### DREDGING IMPACTS

Loss of organisms at the dredge site results from physical removal by the dredge. Depending on the depth dredged, all or most of the resident organisms may be physically removed. Some studies indicate that benthic organisms will recolonize the dredge site (Allen and Hardy 1980). However, in a shipping channel, maintenance dredging of shoaling areas occurs at regular intervals, and may limit recovery of benthic populations. Van Dolah et al. 1990 found some evidence of reduced benthic populations in the Cooper River, which is more heavily developed for port and industrial activities, compared to the less developed Ashley River and Wando River. In the case of the project currently under consideration, most of the dredging would occur in current, deep, maintained channels. Therefore, in these areas, the post project conditions would be similar to pre-project conditions. However, conversion of shallow, soft



bottom benthic faunal communities to deeper water disturbed communities is anticipated at the realignments for the Horse and Shutes/Folly Reaches and along the margins of the deepened channel whose top width will expand due to deepening. Additional conversions may occur with construction of a turning basin and docking accommodation at the site of the new ports terminal.

The impacts of dredging on the more motile components of the Charleston Harbor system will depend upon their ability to avoid the immediate vicinity of the dredge and their individual tolerance to suspended particles generated by dredge operation. Impacts on weaker larval and post-larval organisms which may be present in high concentrations during seasonal immigrations are expected to be greater. The ability of these less motile organisms to avoid dredge entrainment is questionable and suspended particles block gills and food filters of larval fish and invertebrates (Grant 1973). These phenomena are summarized by the U.S. Army Corps of Engineers, Charleston District (1978):

*Action of the dredge cutterhead poses a threat of physical injury or mortality to any creature in its path. However, the mobility of fish populations enables them to avoid this danger, with the exception of weakly mobile embryonic or larval stages which are susceptible to adverse effects when they occur in the vicinity of dredging activity. Actual mortality of these early life forms in significant numbers is unlikely unless they occur in great density however.*

LaSalle (1991) suggests several key criteria in determining whether significant potential impacts may warrant establishment of a dredging "window". One key factor is whether site morphometry allows for organisms to bypass the dredge operation. Since immigration/emigration routes for important estuarine and marine organisms are not confined to the dredged channel area for much of Charleston Harbor, these effects are not likely to be significant. However, organism ingress/egress is largely confined to the dredged channel in the relatively narrow "throat" entrance to the harbor between the jetties and further investigation into a seasonal window for dredging in this area may be appropriate.

Potential water quality impacts at the dredging site include increased turbidity and oxygen demand, and release of contaminants and nutrients - particularly free sulfides, hydrogen sulfide, and ammonia. Good maintenance and dredging practices can limit water quality impacts of pipeline dredging. Overflow from hopper dredges can cause high turbidity levels (Allen and Hardy 1980).

In response to previous concerns relative to hydraulic modification from deepening the harbor channel potentially causing changes in circulation, sedimentation, and salinity patterns, a study was initiated by the Waterways Experiment Station of the Corps of Engineers. Although we have not reviewed the finalized study, our understanding is that modeling efforts have demonstrated no significant changes in these parameters of concern.

Dredging by hopper dredge in the outer entrance channel may result in the incidental take of threatened and endangered sea turtles. Such incidents have been well documented in the literature (Dickerson et al. 1991; National Marine Fisheries Service, 1991). Loggerhead (*Caretta caretta*) and Kemp's ridley (*Lepidochelys kempi*) turtles have been shown to frequent the Charleston Harbor entrance channel when water temperatures are above 16 degrees Celsius (Van Dolah et al. 1993). A seasonal window for hopper dredge operations may be necessary to avoid these impacts. It is our understanding that the Charleston District intends to comply with the dredging restrictions in the November 1991 National Marine Fisheries Service generic biological opinion on channel dredging which should serve to limit impacts on the turtles.

#### DISPOSAL IMPACTS

Loss of habitat at the dredged material disposal site has historically, and continues to be, one of the most obvious significant impacts of channel development. In Charleston Harbor approximately 6,300 acres of wetland habitat, primarily estuarine emergent habitat, has been lost. Deepening Charleston Harbor will require use of capacity in existing disposal areas including the Charleston ODMDS promoting additional pressures for development of new disposal areas.

Water quality may be affected by return waters from upland disposal sites. However, Charleston District reports two sampling events when the removal of suspended solids exceeded 99 percent. Rupture of disposal dikes at existing areas is relatively infrequent but could be disastrous for adjacent sensitive marsh and mudflat systems.

At open water disposal sites such as the ODMDS water quality impacts can be of concern due to the release of large amounts of dredged material into the water column. Recent baseline studies at the ODMDS which measured response of sponge respiration rates have shown that live bottom communities adjacent to fine material dumping sites can be adversely affected (Bob Van Dolah, SCDNR, personal communication). While following the current management plan for the ODMDS will limit such impacts, it may be important to include detailed monitoring of the fate and ecological effects of the materials disposed of at the ODMDS.

#### NEW CONTRACTION DIKE IMPACTS

This analysis is based on the current proposal (construction of a 1000 foot sheet pile structure). Most impacts relate to the construction of the sheet pile wall through the marsh rather than the physical presence of the wall itself. In consideration of sloughing and slope stabilization along the proposed 80 foot (bottom width) by 10 foot (MLW) deep excavated canal and deposition of excavated materials adjacent to the cut, an estimated 320 foot wide by 300 foot long (2.2 acre) marsh area would be affected. Provided that the marsh is successfully restored as proposed, these impacts may be relatively short-term (approximately four to five growing seasons). Degree of impact and recovery will be dependent upon

sensitivity in design and implementation as well as careful monitoring and remediation if necessary of the marsh recovery.

#### SECONDARY (INDIRECT) IMPACTS

The primary purpose of the proposed deepening is to improve commercial navigation primarily for the port and port related industries. Expanded port facilities are important economically for the Charleston area. However, such expansions may result in physical impacts to fish and wildlife resources through direct and indirect effects on habitat and water quality. These impacts may take place at expanded port facilities such as the new container terminal proposed at Daniel Island or at associated industrial sites which are induced by the new or expanded port facilities.

Since the proposed project would use only existing dredged material disposal sites, direct effects of creating new or expanded sites for these purposes are absent. However, as mentioned earlier, use of existing capacity by this project may indirectly require creation of new or expanded disposal sites in the future. This is particularly true in light of the project's predicted increase in annual shoaling quantities of 780,000 cubic yards (Draft Feasibility Report, page 50).

#### COMPARISON OF IMPACTS OF ALTERNATIVE PLANS

As mentioned earlier, alternatives to the project are primarily limited to alternative depths. While the no action alternative would reduce or eliminate the impacts, maintenance of the currently authorized 40 foot deep channel with 2 feet of overdredging and 2 feet of advanced maintenance would still result in the class of impacts typical of dredge operations in shoal buildup areas.

Similarly, selection of a shallower depth alternatives, rather than the 45 foot alternative, would entail conversion of incrementally less undredged bottoms along the channel margins and generate a reduced amount of material to be disposed.

It is unclear how integrally related the dredging of the turning basin and construction of the compression dike for a new terminal at Daniel Island are to the project and planning alternatives. Should the terminal be located further up the Cooper River at the navy base, site specific impacts of the various options would have to be explored at that time.

## RECOMMENDATIONS

Based on the projected impacts above, The Service recommends the following actions/plan modifications to reduce the potential impacts of the project on fish and wildlife resources.

1. Review through interagency committee (i.e., Corps, Service, SCDNR, NMFS) the necessity and particulars of a dredging window for the "throat" of the harbor entrance between the jetties. This process should start by utilizing the methodology described in LaSalle (1991) and concentrate on important windows for ingress and egress of key resources such as penaeid shrimp, blue crab, flounder, and red drum.
2. Establish a dredging window for hopper dredge work based on seasonally restricting work to periods when the water temperature is below 16 degrees Celsius. Coordinate with the National Marine Fisheries Service to implement this and any other necessary measures avoiding hopper dredging impacts to endangered sea turtles.
3. Dispose of suitable materials at the ODMDS in accordance with the signed management plan agreement. Also, in accordance with this plan, coordinate with appropriate agencies to plan for detailed monitoring of disposal operations which track the fate of the materials and their ecological effects (especially for large volumes of fine sediments).
4. Develop, in association with water quality agencies and resource agencies, a water quality management/monitoring plan. The plan should address potential harbor deepening water quality impacts, control measures, and monitoring both at the dredge sites and at disposal areas.
5. Avoid deepening any areas for which modeling indicates a high sedimentation rate.
6. Bulk sediment sampling should be conducted in accordance with the Ocean/Inland Testing Manuals for all areas with the exception of those which meet the exclusion criteria based on sediment grain size. The results of all sediment testing including the completed elutriate tests should be provided to the Service for review.
7. Conduct an alternatives analysis for the new contraction dike in the Cooper River. The analysis should, within engineering efficiency constraints, evaluate location, alignment, and construction alternatives consistent with reduction in impact on intertidal habitats, especially those vegetated with emergent marsh.



#### **POSITION OF THE U.S. FISH AND WILDLIFE SERVICE**

The direct impact areas for the proposed project are largely limited to areas already disturbed for these purposes (i.e., dredging and deepening existing deep navigation channels; disposing of materials in existing disposal areas). As a result, the project should not result in significant and unacceptable impacts to fish and wildlife resources provided that the Service's recommendations (above) are incorporated into the project. The Service favors the shallower 42 foot depth project because of reduced dredge activity and volume both initially and for future maintenance activities. This alternative should be selected over the 45 foot depth alternative unless there is an overriding economic justification for choosing the latter. Environmental documentation in compliance with the National Environmental Policy Act (NEPA) has not been initiated for the new port terminal facility. Therefore, the work proposed in accommodation of the proposed Daniel Island port terminal appears premature and pre-decisional relative to NEPA alternatives analyses for port location.

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Appendix A

FWCA Letters of Concurrence From the National Marine Fisheries Service and  
the South Carolina Department of Natural Resources



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office  
9721 Executive Center Drive North  
St. Petersburg, Florida 33702-2432

February 5, 1996

Mr. Roger Banks  
Supervisor  
Charleston Field Office  
U.S. Fish and Wildlife Service  
P.O. Box 12559  
Charleston, South Carolina 29412

Dear Mr. Banks:

The National Marine Fisheries Service has reviewed the Fish and Wildlife Coordination Act Report on the Charleston Harbor Deepening Study. The report describes fish and wildlife resources in the study area, identifies potential effects on those resources, and provides recommendations for reducing possible impacts.

We concur with the findings made in your agency's report and we endorse implementation of the recommendations provided. By copy of this correspondence we hereby notify the Charleston District of their need to coordinate with our Protected Species Branch personnel concerning possible impacts to shortnose sturgeon and sea turtles. Related correspondence should be addressed to Mr. Charles Oravetz at the letterhead address.

We appreciate the opportunity to review the subject document.

Sincerely,

A handwritten signature in dark ink, appearing to read "David H. Ruckley".

*for* Andreas Mager, Jr.  
Assistant Regional Director  
Habitat Conservation Division

South Carolina Department of  
**Natural Resources**



James A. Timmerman, Jr., Ph.D.  
Director

February 22, 1996

Mr. Roger Banks  
U.S. Fish & Wildlife Service  
P.O. Box 12559  
Charleston, SC 29422-2559

Dear Mr. Banks:

Personnel of the South Carolina Department of Natural Resources have reviewed the Fish and Wildlife Coordination Act Report on Charleston Harbor Deeping Study and concur in its findings and recommendations.

Sincerely,

A handwritten signature in dark ink, appearing to read "Ed Duncan", is written over a horizontal line.

Robert E. Duncan  
Environmental Programs Director

**APPENDIX D**  
**ENVIRONMENTAL CORRESPONDENCE**



**South Carolina Department of Archives and History**

1430 Senate Street, P.O. Box 11,669, Columbia, South Carolina 29211, (803) 734-8577  
State Records (803) 734-7914; Local Records (803) 734-7917

January 9, 1996

Lt. Col. Thomas F. Julich  
District Engineer, Corps of Engineers  
Charleston District  
P. O. Box 919  
Charleston, SC 29402-0919

Re: Charleston Harbor Deepening  
Draft Feasibility Report and  
Environmental Assessment

Attn.: Mr. Braxton Kyzer

Dear Col. Julich:

Thank you for your letter of January 2, 1996, and a copy of the "Draft Feasibility Report and Environmental Assessment for Charleston Harbor, South Carolina".

We have reviewed the sections that address cultural resources and have no additional comments.

We appreciate the opportunity to comment. If you have questions, please call me at 803/734-8615.

Sincerely,

A handwritten signature in cursive script, appearing to read "Nancy Brock".

Nancy Brock, Supervisor  
Review and Compliance Branch  
State Historic Preservation Office

South Carolina Department of  
**Natural Resources**



James A. Timmerman, Jr., Ph.D.  
Director

Alfred H. Vang  
Deputy Director for  
Water Resources

February 6, 1995

Ms. Robin Socha  
EN-PB  
Dept. of the Army  
Charleston District, Corps of Engineers  
P.O. Box 919  
Charleston, SC 29402-0919

RE: Charleston Harbor Deepening Project

Dear Robin,

I have reviewed the 404(b)(1) Evaluation for the Charleston Harbor Deepening Project for any potential adverse impacts on underlying aquifers. The project involves deepening the Charleston Harbor from 40 feet to between 42 and 45 feet below mean low water.

According to SCDNR-WRD records, the top of the Cooper Formation lies between the approximate elevations of -10 and -60 feet mean sea level in the project area, with thickness varying from 200 to 260 feet. This formation acts as the upper confining layer to the Santee Limestone. The aquifers of the Santee Limestone and the underlying Black Mingo Formation contain salt water in the vicinity of Charleston Harbor.

In light of hydrogeologic conditions, no adverse impacts to aquifers are expected as a result of deepening Charleston Harbor by a maximum of five feet. Should you need additional information, please feel free to contact this office.

Sincerely,

*Brenda L. Hockensmith P.G.*  
Brenda L. Hockensmith, P.G.  
Senior Hydrologist

cc: Rod Cherry, Section Chief  
A. Drennan Park, Regional Hydrologist  
file

# South Carolina Department of Natural Resources



James A. Timmerman, Jr., Ph.D.  
Director

January 18, 1995

LTC George H. Hazel  
District Engineer  
U.S. Army Corps of Engineers  
P.O. Box 919  
Charleston, SC 29402-0919

REF: P/N 94-1R-498 - Charleston Harbor Deepening & Widening Project  
Charleston County

Dear Colonel Hazel:

The South Carolina Department of Natural Resources has reviewed the above referenced public notice which proposes the deepening, widening and realignment of the federal navigation channel for Charleston Harbor, South Carolina.

The plan consists of deepening Charleston Harbor from the existing project depth of 40 feet to 42 feet as a minimum depth and 45 feet as a maximum depth below MHW with 2 feet of allowable overdepth and 2 feet of advance maintenance.

The navigation channel would be 800 feet wide beyond the jetties. Within the jetties the channel width would remain at 1000 feet, reducing to 600 feet wide near Sullivan's Island and remaining at 600 feet wide for the remainder of the federal navigation project. The width of Daniel Island Reach would vary from approximately 875 feet to 600 feet for proposed terminal access. The entrance channel would extend to approximately the 51 foot ocean contour. Channel realignment would include Horse Reach and Shutes Folly Reach to improve navigability.

Dredged material is proposed to be placed in existing upland disposal areas and at the Charleston Ocean Disposal Site (ODMS). Potential upland disposal sites include Clouter Creek Disposal Site, Daniel Island Disposal Site and Morris Island Disposal Site.

The U.S. Fish and Wildlife Service has submitted to you a comprehensive draft Fish and Wildlife Coordination Act Report on the project, dated December, 1994, which provides an overview of the possible impacts to fish and wildlife resources that might occur as a result of the project and recommendations of measures to provide for optimum protection of those resources.

The DNR was consulted during the preparation of the report and has reviewed it in detail. We concur with its findings and recommendations and request that they be accepted as the position of the Department of Natural Resources.

Sincerely,

  
Robert E. Duncan  
Environmental Programs Director

cc: OCRM/Moore  
USFWS  
USEPA  
NMFS





Commissioner: Douglas E. Bryant  
 Board: John H. Runkle, Chairman  
 Sandra J. Molander, Secretary

Richard E. Johnson, DDS  
 William M. Hall, Jr., MD  
 Peter Laska, Jr.

Promoting Health. Protecting the Environment

May 2, 1995

U.S. Army Corps of Engineers  
 Charleston District  
 P.O. Box 919  
 Charleston, SC 29402-0919

Post-It Fax Note	7671	Date	5-4-95	Page	2
To	Robin Sachs	From	Heather Skelworth		
Co./Dept	Corps	Co.	DHEC		
Phone #		Phone #	781-5301		
Fax #	727-4260	Fax #			

Re: Certification in Accordance with Section 401 of the  
 Clean Water Act, as amended.

U.S. Army Corps of Engineers  
 Dredging  
 Charleston Harbor  
 Charleston County  
 P/N 94-1R-498

Dear Sir:

We have reviewed plans for this project and determined there is a reasonable assurance that the proposed project will be conducted in a manner consistent with the Certification requirements of Section 401 of the Federal Clean Water Act, as amended. In accordance with the provisions of Section 401, we certify that this project, subject to the indicated conditions, is consistent with applicable provisions of Section 303 of the Federal Clean Water Act, as amended. We also hereby certify that there are no applicable effluent limitations under Sections 301(b) and 302, and that there are no applicable standards under Sections 306 and 307.

This certification is subject to the following conditions:

1. Dredging must be limited, when possible, to the winter months when D.O. concentrations are highest and biological activity is lowest (Nov. 1 through Mar. 31).
2. Monitoring reports from the chosen disposal sites should be routinely submitted to the Department's Division of Water Quality for review.

The S. C. Department of Health and Environmental Control reserves the right to impose additional conditions on this Certification to respond to unforeseen, specific problems that might arise and to take any enforcement action necessary to ensure compliance with State water quality standards.

Sincerely,

*Sally C. Knowles*

Sally C. Knowles, Director  
 Division of Water Quality  
 and Shellfish Sanitation  
 Bureau of Water Pollution Control

SCK:HWS

cc: Army Corps of Engineers,  
 Charleston District  
 Trident District Office  
 OCRM



Commissioner: Douglas E. Bryant

Board: John H. Burris, Chairman  
Sandra J. Melander, Secretary

Promoting Health, Protecting the Environment

Richard E. Jabbar, DDS,  
William M. Hull, Jr., MD  
Roger Leake, Jr.

**Office of Ocean and Coastal Resource Management**

H. Wayne Beam, Ph.D., Deputy Commissioner

Christopher L. Brooks, Assistant Deputy Commissioner

(803) 744-5838

(803) 744-5847 (fax)

February 1, 1996

Mr. Richard M. Jackson, P. E.  
Charleston District Corps of Engineers  
Post Office Box 819  
Charleston, South Carolina 29402-0919

Re: Amendment to Charleston Harbor  
Deepening Widening Project  
Charleston county  
Federal Consistency

Dear Mr. Jackson:

The staff of the Office of Ocean and Coastal Resource Management (OCRM) certifies that the above referenced project is consistent with the Coastal Zone Management Program. This project approval is based upon revised plans submitted to SCDHEC/OCRM on January 31, 1996, and marked as such. Except as shown on these plans, no construction is to occur in any wetland areas. These plans do not include approval for construction of the proposed Daniel Island Terminal Facility.

Interested parties are provided ten days from receipt of this letter to appeal the action of the OCRM.

Sincerely,



Robert D. Mikell  
Director of Planning and  
Federal Certification

JHA/23197/jk

cc: Dr. H. Wayne Beam  
Mr. Christopher L. Brooks  
Mr. H. Stephen Snyder



Commissioner Douglas E. Snyder

Board: Richard E. Johnson, DDS, Chairman  
Robert J. Stripling, Jr., Vice Chairman  
Brenda J. Melander, Secretary

Promoting Health, Protecting the Environment

John H. Burtis  
William M. Hall, Jr., MD  
Roger Latta, Jr.  
Gerald R. Mayhew, D

**Office of Ocean and Coastal Resource Management**

H. Wayne Beam, Ph.D., Deputy Commissioner

Christopher L. Brooks, Assistant Deputy Commissioner

(803) 744-5838

(803) 744-5847

March 10, 1988

LTC George H. Hazel  
District Engineer  
U. S. Army Corps of Engineers  
Post Office Box 919  
Charleston, South Carolina 29402-0919

Re: Charleston Harbor Deepening/  
Widening Project  
Charleston County  
PWS 84-1R-488  
Federal Consistency

Dear Col. Hazel:

The Office of Ocean and Coastal Resource Management concurs with the recommendations of the U. S. Fish and Wildlife Service.

The staff of the Office of Ocean and Coastal Resource Management (OCRM) certifies that the above referenced project is consistent with the Coastal Zone Management Program to the maximum extent practicable. This certification shall serve as the final approval by the OCRM.

Interested parties are provided ten days from receipt of this letter to appeal the action of the OCRM. The action approved herein shall become final ten days from receipt of this letter provided no appeal is received.

Sincerely

H. Stephen Snyder  
Director of Coastal Zone  
Management Division

JTA

JTA/21231/ASB

cc:

Dr. H. Wayne Beam  
Mr. Christopher L. Brooks  
Mr. Robert D. Mihal  
Mr. Ed Duncan  
Ms. Sally Knowles  
U. S. Environmental Protection Agency

Planning Branch

FEB 14 1995

Mr. Roger L. Banks  
U.S. Fish and Wildlife Service  
P.O. Box 12559  
Charleston, South Carolina 29422-2559

Dear Mr. Banks:

The U.S. Army Corps of Engineers, Charleston District has reviewed the Draft Fish and Wildlife Coordination Act Report on the Charleston Harbor Deepening Study and offers the following comments on the report:

1. Page iii, second paragraph - The channel in the Cooper River to Goose Creek is generally 600 feet in width and the channel in the Wando River to the Wando terminal is 400 feet in width.

2. Page iii & iv - Service Recommendations

a. "Review through interagency committee (i.e., Corps, Service, SCDNR, NMFS) the necessity and particulars of a dredging window for the "throat" of the harbor entrance between the jetties. This process should start by utilizing the methodology described in LaSalle (1991) and concentrate on important windows for ingress and egress of key resources such as penaeid shrimp and red drum."

The deepening work in the entrance channel may be conducted in conjunction with maintenance contracts involving hopper or hydraulic dredges depending on the type of material that is scheduled to be dredged. Our office will review the LaSalle methodology in consideration of the recommended species.

b. "Prepare an analysis of the effect of the project on the provided endangered and threatened species list for Service and National Marine Fisheries Service concurrence."

Correspondence to complete the above is underway.

c. "Establish a dredging window for hopper dredge work based on seasonally restricting work to periods when the water temperature is below 16 degrees Celsius. Coordinate with the National Marine Fisheries Service to implement this and any other necessary measures avoiding hopper dredging impacts to endangered sea turtles."

A dredging window of December 1 to March 31 for avoidance of sea turtles is presently in place for hopper dredging and is adhered to by the Corps of Engineers (COE). However, the COE has spent \$3.5 million on a turtle research program. A draghead that will prevent or significantly reduce entrainment of sea turtles by hopper dredges was developed. If these dragheads continue to function as expected and become available, they may be used in lieu of a dredging window, following coordination with state and federal resource agencies.

d. "Dispose of suitable materials at the ODMDS in accordance with the signed management plan agreement. Also, in accordance with this plan, coordinate with appropriate agencies to plan for detailed monitoring of disposal operations which track the fate of the materials and their ecological effects (especially for large volumes of fine sediments)."

A contract is presently underway to start testing the proposed dredged material to determine suitability for ocean disposal. This information will be available prior to any deepening. Because of the quantity of the material, it is expected that the deepening work will be conducted in conjunction with maintenance dredging contracts over a period of years. The Charleston District has a monitoring and management plan in place for the Charleston ODMDS that was written through coordination with a resource agency "task force". Intensive monitoring of the site has been conducted for the last two years and is continuing. Monitoring will continue as agreed upon in the management plan but will probably be modified with consideration given to the dredging project scope of work and the recommendations of the task force.

e. "Develop, in association with water quality agencies and resource agencies, a water quality management/monitoring plan. The plan should address potential harbor deepening water quality impacts, control measures, and monitoring both at the dredge sites and at disposal areas."

The 404(b)(1) for this project addresses impacts, minimization measures and discusses the monitoring of upland disposal sites as per agreement with the South Carolina Department of Health and Environmental Control (SCDHEC). Contracts for dredging activities address environmental issues as required by law, and COE Quality Assurance Personnel oversee the dredging contracts and inspect/monitor the dredging operations to ensure compliance. Monitoring/testing of effluent at the disposal areas will continue as per the agreement with SCDHEC.

f. "Avoid deepening any areas for which modeling indicates a high sedimentation rate."

The channel realignment was proposed in order to eliminate a navigation hazard - the sharp turn at Horse Reach and Shutes/Folly Reach, and to accommodate larger shipping traffic. It is possible that the realignment may cause additional shoaling which cannot be avoided, but unusually high sedimentation rates are not expected.

g. "Bulk sediment sampling should be conducted in accordance with the Ocean/Inland Testing Manuals for all areas with the exception of those which meet the exclusion criteria based on sediment grain size. The results of all sediment testing including the completed elutriate tests should be provided to the Service for review."

Total and dissolved modified elutriate tests have been performed in accordance with the Inland Testing Manual and using the methods developed by WES. These tests have been performed on material identified for placement in existing upland disposal areas as required by SCDHEC for Section 401 Water Quality Certification. Results of these analyses are enclosed. As noted in item 4. above, physical, chemical and biological testing of the proposed dredged sediments began in mid-January 1993, with initial results expected in March 1993. Results will be made available to anyone or any agency who requests the information.

3. Page 2 - Change 3000 cfs to 4500 cfs in the second full paragraph. Prior to implementation of the diversion project in 1986, WES investigated various flow releases from Pinopolis Dam. The amount of 4500 cfs weekly average was recommended and has been in practice ever since the beginning of the project.

4. Page 3, Figure 1 - Label Morris Island and Mt. Pleasant.

5. Page 4, Existing Navigation Project - It should be noted that some changes were made to the authorized project as discussed below:

- a. The turning basin diameter at the head of the Cooper River was enlarged to 1,400 feet.
- b. The first tangent and the lower turning basin in Shipyard River were deepened to 38 feet. Deepening of the upper Shipyard River channel was deferred.
- c. Widening about 2,000 feet of the upper Shipyard River Channel to 250 feet was deferred.
- d. Enlargement of the two Shipyard River turning basins was deferred.
- e. Enlarging and deepening the anchorage basin at the junction of the Cooper and Ashley Rivers to 40 feet was deferred.
- f. The Columbus Street turning basin was relocated and enlarged to 1,400 feet.

6. Page 4, second to the last paragraph - Advance maintenance dredging is conducted prior to overdepth dredging. Please list advance maintenance before overdepth dredging in the report.

7. Page 6, last paragraph (3) - Models conducted by WES indicate that the deepening project will not cause any affects to the salinity distribution in the harbor.

8. Page 7, third paragraph (6) - As described in the public notice for 401 Water Quality Certification and in the 404(b)(1) Evaluation, this project does not address the impacts associated with new or expanded port facilities because the COE is not responsible for construction of port facilities. The South Carolina State Ports Authority will address impacts related to additional port facilities when the facility(s) and proposed location(s) are determined.

9. Page 8, middle of the third paragraph - The contractors are not "disposal" contractors, they are "dredging" contractors.

10. Page 8, last paragraph - The COE does not intend to develop any new upland disposal sites in the foreseeable future.

11. Page 9, first paragraph - Why would there be an increase in ocean derived sediments introduced into the harbor following the deepening project? Please explain.

12. Page 10, #4 - The COE has spent \$3.5 million over the last few years on a turtle research study. A new draghead has been developed in an attempt to reduce/eliminate the impacts to sea turtles from hopper dredging. Additionally, the Charleston District has cooperated with the National Marine Fisheries Service in trawling prior to dredging, and in dredging only during the turtle "window". Other "measures" are not referenced in the report. What additional measures are needed?

13. Page 15, last paragraph -

a. The entrance channel will slope to the 47 foot contour (for the 45 foot project depth). No advance maintenance or overdepth will be applied.

b. Advance maintenance dredging is conducted prior to overdepth dredging. Please list advance maintenance before overdepth dredging in the report on pages 15 and 16.

c. Some minor changes in the project include:

(1). The channel approaching the jetties from the ocean is 800 feet in width. Just outside the jetties, the channel will widen to 1000 feet, returning to 800 feet within the jetties and further reducing in width to 600 feet near Sullivan's Island.

(2). There are no further changes in the channel width for the remainder of the project. The channel ranges from 500 to 800 feet in width with two exceptions. The Daniel Island Reach will vary from approximately 600 feet to 875 feet in width for proposed terminal access, and the Horse Reach and Shutes/Folly Reach, where realignment is proposed, will be 900 feet to 1000 feet in width.

14. Page 16, first paragraph - Upland disposal for the dredged material include the Navy Weapons Station Disposal Area and Drum Island Disposal Area.

15. Page 16, third paragraph - It should be noted that the entire channel is not dredged during maintenance dredging. Maintenance dredging is relatively site specific with dredging being conducted in the same locations where shoals reoccur. As a result, benthic organisms throughout the entire channel are not impacted.

16. Page 20, Recommendations - these are addressed at the beginning of this comment letter.

17. As a general comment, project depths considered for the study range from 42 feet mlw to 45 feet mlw at one foot increments. A 42 foot channel and a 45 foot channel are not the only two designs considered, they are the limits of depths being considered for this study.

18. Lastly, the correspondence from your office dated December 20, 1994 was in response to public notice 94-1R-498 for the deepening project. Your correspondence was apparently copied to the South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management and to the Office of Water Quality Certification. My office has received telephone calls from both offices requesting our response to your correspondence. A letter response for a federal project is unnecessary when a Fish and Wildlife Coordination Act Report from your office is required by law. The Coordination Act Report provides the required response to the public notice. Furthermore, a draft report should be received by our office with sufficient time to review, comment and receive a final document prior to issuance of information within the document to other agencies. We would appreciate your consideration of this in the future.

19. We appreciate the effort involved in the development of the Coordination Act Report for this project and look forward to receiving the final document. If you have any further questions, please contact Robin Collier-Socha at 803/727-4696.

Respectfully,

C-SOCHA/4696/K

PREACHER/EN-PR

JACKSON/EN-2

GEORGE H. HAZEL  
Lieutenant Colonel, U.S. Army  
District Engineer

KYZER/PM-

HERNDON/TV

WATERS/EN

HAZEL/E

Enclosure



February 5, 1996

Planning Branch

Mr. Roger L. Banks  
U.S. Fish and Wildlife Service  
P.O. Box 12559  
Charleston, South Carolina 29422-2559

Dear Mr. Banks:

The U.S. Army Corps of Engineers, Charleston District has reviewed the Fish and Wildlife Coordination Act Report on the Charleston Harbor Deepening Study and offers the following responses to your recommendations on page 21:

1. Review through interagency committee (i.e., Corps, Service, SCDNR, NMFS) the necessity and particulars of a dredging window for the "throat" of the harbor entrance between the jetties. This process should start by utilizing the methodology described in LaSalle (1991) and concentrate on important windows for ingress and egress of key resources such as penaeid shrimp, blue crab, flounder, and red drum.

Response - Dredging in Charleston Harbor is currently restricted to a winter window for hopper dredging which is in accordance with a NMFS Biological Opinion to protect endangered sea turtles. Hydraulic dredging has never been restricted to a window because the impacts are insignificant and short-term. Consequently, the Charleston Harbor channel deepening and turning basin excavation will be conducted in conjunction with standard dredging maintenance protocol. Dredging between the jetties will continue to be accomplished with a hopper dredge, and therefore, would be restricted to a winter window.

2. Establish a dredging window for hopper dredge work based on seasonally restricting work to periods when the water temperature is below 16 degrees Celsius. Coordinate with the National Marine Fisheries Service to implement this and any other necessary measures avoiding hopper dredging impacts to endangered sea turtles.

Response - The Corps South Atlantic Division has recently completed Section 7 coordination with the NMFS to protect endangered sea turtles from the effect of hopper dredging. This coordination included several years of specific studies to determine the most effective method/methods to protect sea turtles. An incidental take limit was established by the NMFS with Reasonable and Prudent Measures to insure that the take is not exceeded. The Reasonable and Prudent Measures include a winter season window

(when the water temperature is most often below 16 degrees Celsius), a newly designed drag arm head, and an observer program to monitor the dredge overflow screens.

3. Dispose of suitable materials at the ODMDS in accordance with the signed management plan agreement. Also, in accordance with this plan, coordinate with appropriate agencies to plan for detailed monitoring of disposal operations which track the fate of the material and their ecological effects (especially for large volumes of fine sediments).

Response - All dredged material will be tested to determine suitability for ocean disposal prior to any deepening work. The Charleston District has a monitoring and management plan in place for the Charleston ODMDS that was written through coordination with a resource agency "task force". Intensive monitoring of the site has been conducted for the last two years and is continuing. Monitoring will continue as agreed upon in the management plan but will probably be modified with consideration given to the dredging project scope of work and the recommendations of the task force.

4. Develop, in association with water quality agencies and resource agencies, a water quality management/ monitoring plan. The plan should address potential harbor deepening water quality impacts, control measures, and monitoring both at the dredged sites and at disposal areas.

Response - The 404(b)(1) for this project addresses impacts, minimization measures and discusses the monitoring of upland disposal sites as per agreement with the South Carolina Department of Health and Environmental Control (SCDHEC). Contracts for dredging activities address environmental issues as required by law, and COE Quality Assurance personnel oversee the dredging contracts and inspect/monitor the dredging contracts and inspect/monitor the dredging operations to insure compliance. Monitoring /testing of effluent at the disposal area will continue as per the agreement with SCDHEC.

5. Avoid deepening any area for which modeling indicates a high sedimentation rate.

Response - Channel realignment at Horse Reach and Shutes/Folly Reach were proposed in order to eliminate navigation hazards and to accommodate larger shipping. The turning basin is necessary to allow ships a safe area to turn around. The proposed location of the contraction dike will reduce shoaling in the Daniel Island reach by almost 50%. It is possible that the realignment may cause additional shoaling which cannot be avoided, but unusually high sedimentation rates are not expected in either the realignments or the turning basin.

6. Bulk sediment sampling should be conducted in accordance with the Ocean/ Inland Testing Manuals for all areas with the exception of those which meet the exclusion criteria based on sediment grain size. The results of all sediment testing including the completed elutriate tests should be provided to the Service for review.

Response - Total and dissolved modified elutriate tests have been performed in accordance with the Inland Testing Manual and using the methods developed by The Waterways Experiment Station (the turning basin area is currently being tested). These tests have been or are being performed on material identified for placement in existing upland disposal areas as required by SCDHEC for Section 401 Water Quality Certification. Result from testing is available or will be available to any agency who requests the information.

7. Conduct an alternative analysis for the new contraction dike in the Cooper River. The analysis should, within engineering efficiency constraints, evaluate location, alignment, and construction alternatives consistent with reduction in impact on intertidal habitat, especially those vegetated with emergent marsh.

Response - A model of this project including the location of the contraction dike was prepared by The Waterways Experiment Station (WES). The contraction dike was located by WES with consideration given to navigation safety, location of the proposed turning basin, and location of an existing degaussing pier. However, shoaling reduction was the prime purpose for the location. The proposed location of the contraction dike located as it is will reduce shoaling in the Danial Island reach by almost 50 %. All marsh effected will, upon completion of the dike, be restored to its natural productive state (this is addressed in the Project Environmental Assessment).

I appreciate the effort involved in the development of the Coordination Act Report for this project. If you have any further questions, please contact Mr. Jim Woody of my staff at (803) 727-4759.

Respectfully,

Richard M. Jackson, P.E.  
Acting Chief, Engineering and Planning  
Division

WOODY/4759/KH

K.HARRIS/EN-P

PREACHER/EN-PR

DENNEN/PH

CASBEER/EN-PE

JACKSON/A-EN



United States Department of the Interior



FISH AND WILDLIFE SERVICE  
P.O. Box 12559  
217 Fort Johnson Road  
Charleston, South Carolina 29422-2559

February 5, 1996

Lt. Colonel Thomas F. Julich  
District Engineer  
U.S. Army Corps of Engineers  
P.O. Box 919  
Charleston, S.C. 29402-0919

Re: Charleston Harbor Deepening Project, FWS Log No. 4-6-96-116

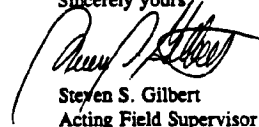
Dear Colonel Julich:

The U.S. Fish and Wildlife Service has reviewed planned modifications to the above-referenced project relative to potential effects on endangered species. The modifications include refurbishment of two existing contraction dikes and construction of a new contraction dike and turning basin all in association with a proposed new Daniel Island ports terminal.

We have reviewed the January 31, 1996 letter from Mr. Richard M. Jackson of your Planning Branch wherein the District's Biological Assessment that none of the listed species potentially occurring in the project area would be effected by the deepening project is expanded to include the above project modifications. Based on our review of the modifications, we will concur with a determination that this action is not likely to adversely affect federally listed endangered and threatened species. In view of this, we believe that the requirements of Section 7 of the Endangered Species Act have been satisfied. However, obligations under Section 7 of the Act must be reconsidered if (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered, (2) this action is subsequently modified in a manner which was not considered in this assessment, or (3) a new species is listed or critical habitat determined that may be affected by the identified action.

Your interest in ensuring the protection of endangered and threatened species is appreciated.

Sincerely yours,



Steven S. Gilbert  
Acting Field Supervisor

January 31, 1996

Planning Branch

Mr. Roger L. Banks, Field Supervisor  
US Fish and Wildlife Service  
PO Box 12559  
Charleston, South Carolina 29412

Dear Mr. Banks:

The purpose of this letter is to advise you of modifications being planned for the Charleston Harbor deepening project. The modifications include refurbishment of two existing contraction dikes and construction of a new contraction dike and turning basin. The refurbishment of existing dikes and construction of the new contraction dike are necessary to reducing shoaling in the Daniel Island reach by 50% (See figures 1 and 2).

The existing contraction dikes proposed for refurbishment lie on the west side of the Cooper River, downstream of Shipyard River and upstream of the U.S. Navy degaussing pier. The proposed new contraction dike will be located approximately 150 feet upstream of the U.S. Navy degaussing pier, between the two existing contraction dikes. Marl from the deepening project will be used to provide a foundation base for the proposed dike. Approximately 180,000 cubic yards of marl will be placed as a base with a 12-inch foundation blanket equaling 4000 cubic yards of 6-inch to 12-inch stone. Sheet piling will be sunk into the base marl and foundation stone. The dike will be approximately 1000 feet in length, 300 feet of which is vegetated wetlands on the shoreward end. After excavation and construction of the dike is completed, the effected marsh will be restored on each side of the dike to its original elevation so that marsh grasses will reestablish. The extreme shoreward end of the dike, where it ties into upland will require riprap to prevent scouring. Approximately 800 sq. ft. of emergent wetland will be covered over by this riprap tie-back. Repairs to the two existing dikes will take place within their existing footprint. In addition to the contraction dikes, a turning basin located north of Shipyard River and south of the existing contraction dike (see figure 2) is proposed for construction. The turning basin will be deepened to the same depth as Charleston Harbor which is 49 feet including maintenance and overdepth. Material from the turning basin (3 million cubic yards) will be placed in a diked disposal area. The total area of benthic impact will be approximately 80 acres.

A list of endangered and threatened species which could be impacted by the Charleston Harbor deepening project was received from your office on January 11, 1995. It is assumed that this list has not changed. On March 6, 1995, you concurred with the District's Biological Assessment that none of the listed species would be effected by the deepening project if it was constructed in accordance with a previously coordinated Biological Opinion prepared by your office for hopper dredging. We believe that the modifications described above also would not affect any of the listed species and further believe that reinitiating consultation under the Endangered Species Act for the modifications is unnecessary.

We request your concurrence with this letter. Should you have any additional questions regarding this project, please contact Mr. Jim Woody of my staff at (803) 727-4759.

Respectfully,

Richard M. Jackson, P.E.  
Chief, Planning Branch

Enclosures

WOODY/4759/KH

K.HARRIS/EN-P

PREACHER/EN-PR

JACKSON/EN-P

February 2, 1996

Planning Branch

Mr. Andreas Mager, Jr.  
Assistant Regional Director  
National Marine Fisheries Service  
9721 Executive Center Drive N.  
St. Petersburg, Florida 33702

Dear Mr. Mager:

This is in response to your letters dated 5 December 1995, commenting on the Draft Feasibility Report and Draft Environmental Assessment for the Charleston Harbor Deepening Project, and another dated 18 January 1996, commenting on a District Public Notice (95-1R- 406). The Public Notice was issued as an amendment to the original plan described in the Draft Feasibility Report. These letters identified several areas of concern to the NMFS which I am responding to.

December 5, 1995 Letter

Comment 1. - Atlantic Sturgeon and Shortnose Sturgeon should be added to the final Report.

Response - Agree, these sturgeon will be included in the final report.

Comment 2. - Details are needed concerning the composition of benthic communities to be affected by contraction dike repairs and construction, and construction of the Daniel Island turning basin. If sampling of these communities is not planned, then relevant data and conclusions used in your analysis should be provided.

Response - The most recent study conducted on Charleston Harbor benthos was conducted in 1990 by the Marine Resources Division of the South Carolina Department of Natural Resources (A Physical and Ecological Characterization of the Charleston Harbor Estuarine System). This study included benthic sampling at several stations near the proposed turning basin and contraction dike and indicates that water quality and toxic sediments have a greater effect on benthic organisms than dredging. Additional studies conducted over the years by the Army Corps of Engineers, Charleston District and Waterway Experiment Station have specifically shown that the most significant impacts of hydraulic dredging is the destruction of benthic invertebrates in the path of the dredge

cutterhead. These studies have also shown that channel dredging has very little long term effects on the health, number and diversity of Harbor benthic resources.

The greatest concentration of benthic invertebrates in the Charleston Harbor estuary occur in and around salt marshes in lieu of the deeper channel. The specific areas identified for the new contraction dike and turning basin, however, contain no shellfish beds or communities. Common invertebrates in the vicinity of the proposed contraction dike include fiddler crabs and the common marsh periwinkle snails. Construction of the turning basin will cause destruction of benthos in the immediate vicinity of the cutterhead. Benthos not trapped by the cutterhead will be displaced to shallow bottoms. Deepening in the present navigation channel, where maintenance of recurring shoals are dredged on a 12 to 18 month rotation, is not expected to significantly effect Harbor benthic resources. Scientific studies have repeatedly shown a short-term rate for recovery of benthos following dredging operations, provided water quality and bottom sediment are free of pollutants.

Comment 3. - " details regarding proposed creation of regularly flooded wetlands, as needed to offset areas affected by the proposed contraction dike are needed. For example, the approximate size, location, and work completion date for the mitigation".

Response - The new contraction dike which was originally designed with a causeway filling approximately 2 acres of salt marsh has been redesigned. The new design does not include a causeway or subsequent wetland fill, but will allow the effected salt marsh to be restored to its original elevation and productivity. This new design will be clarified in the final report and EA.

Comment 4. - Coordinate the present plan with NMFS Protected Species Branch.

Response - Coordination of the final report with NMFS Protected Species Branch was initiated on January 31, 1996.

#### January 18, 1996 Letter

Comment 1. - Restriction of all work involving excavation and filling of aquatic habitats to periods of low biological activity. This would limit such work to December 1 through March 15 of any year.

Response - Dredging in Charleston Harbor is currently restricted to a winter window for hopper dredging which is in accordance with a NMFS Biological Opinion to protect endangered sea turtles. Hydraulic dredging has never been restricted to a window because the impacts are insignificant and short-term. Consequently, the Charleston Harbor channel deepening and turning basin excavation will be conducted in conjunction with maintenance contracts. The U.S. Fish And Wildlife Service Coordination Act report recommended "a review through interagency committee the necessity and particulars of a dredging window



for the "throat" of the harbor entrance between the jetties". Dredging between the jetties would be accomplished with a hopper dredge and, therefore, restricted to a winter window.

Comment 2. - Assessment of the location and size of shellfish beds (if any) in the vicinity of all proposed excavation and fill activities.

Response - There are no identified shellfish beds in areas of the harbor proposed for this project.

Comment 3. - Avoidance to the extent practicable, of the loss and degradation of productive shellfish (hard clam) beds, intertidal habitats, and emergent wetlands.

Response - This project will be designed in its final phase to employ "avoidance techniques" where practicable.

Comment 4. - Development of remedial measures needed to off set unavoidable wetland and aquatic resource impacts.

Response - See comment 3 and response under the December 5 letter above.

Thank you for your willingness to cooperate with the Charleston District in the design of this project to insure that project purposes are met and South Carolina's natural resources are sufficiently protected. If you should have questions, please contact Mr. Jim Woody of my staff at (803) 727-4759.

Respectfully,

Richard M. Jackson, P.E.  
Chief, Planning Branch

WOODY/4759/KE

K HARRIS/EN-F

DENN/EN-PF

PREACHER/EN-PF

CASBEER/EN-PF

JACKSON/EN-I



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office  
9721 Executive Center Drive N.  
St. Petersburg, Florida 33702

December 5, 1995

Lt. Colonel Thomas F. Julich  
District Engineer, Charleston District  
U.S. Army Corps of Engineers  
P.O. Box 919  
Charleston, South Carolina 29402-0919

Dear Colonel Julich:

The National Marine Fisheries Service has reviewed the Draft Feasibility Report and Draft Environmental Assessment (DEA) for the Charleston Harbor Deepening Project, Charleston County, South Carolina. Based on the information contained in these documents, we generally concur with your determination that long-term adverse impacts to living marine resources are unlikely. In making this determination, we note that planned improvement of existing contraction dikes; construction of a third contraction dike; and excavation of the Daniel Island turning basin have been recently proposed and are only briefly addressed in the DEA. Since details regarding the environmental consequences of these additional features will be provided in the final environmental document, additional comments may be forthcoming.

Specific comments

Draft Feasibility Report

Page 15, Paragraph 1. Atlantic sturgeon (*Acipenser oxyrinchus*) and shortnose sturgeon (*Acipenser brevirostrum*) have been reported from the Cooper and Ashley Rivers and should be included in the list of anadromous fish provided in this section.

Draft Environmental Assessment


Page 6, first paragraph. Details are needed concerning the composition of benthic communities to be affected by constriction dike repairs and construction, and construction of the Daniel Island turning basin. If sampling of these communities is not planned, then relevant data and conclusions used in your analysis should be provided.

Page 7, last paragraph. Details regarding proposed creation of regularly flooded wetlands, as needed to offset areas affected by the proposed constriction dike, are needed. For example, the approximate size, location, and work completion date for the mitigation should be provided.

Finally, we note that while coordination with our Protected Species Branch has been performed, it preceded the present plan of action. As appropriate, you should inform the Branch of changes that may affect endangered or threatened species or their habitat.

We appreciate the opportunity to provide these comments.

Sincerely,

  
Andreas Mager, Jr.  
Assistant Regional Director  
Habitat Conservation Division



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
Southeast Regional Office  
9721 Executive Center Drive North  
St. Petersburg, Florida 33702-2432

January 18, 1996

Lt. Colonel Thomas F. Julich  
District Engineer, Charleston District  
Department of the Army, Corps of Engineers  
P.O. Box 919  
Charleston, South Carolina 29402-0919

Dear Colonel Julich:

The National Marine Fisheries Service (NMFS) has reviewed Public Notice 95-1R-406 which announces addition of components to the Corps of Engineers' Charleston Harbor Deepening Project, Charleston County, South Carolina. The NMFS provided comments on the overall project and the Draft Environmental Assessment in our letter dated December 5, 1995. Planned additional work includes refurbishing of two existing contraction dikes; construction of a third contraction dike; and excavation of a ship turning basin. Planned activities would occur in waters of the Cooper River (Charleston Harbor) and involve:

- o Construction of a 300-foot-long solid-fill marl causeway and 700-foot-long sheet-pile dike covering approximately 2 acres of regularly flooded wetlands and 4 acres of intertidal and subtidal unconsolidated estuarine bottom.
- o Construction of an 80-acre (approximate) by 49-foot-deep ship turning basin in submerged bottom.
- o Placement of 3 million cubic yards of dredged material in the Clouter Island diked disposal site.

Three distinct aquatic zones -- unconsolidated deepwater bottom, intertidal flats, and emergent wetlands would be affected by the additional work. Unconsolidated deep-water bottoms in the vicinity of Charleston Harbor generally do not support large populations of commercially or ecologically important benthic organisms. Possible exceptions include bivalves such as hard clams (*Merccenaria mercenaria*); transitory invertebrates such as blue crabs (*Callinectes sapidus*) and shrimp (*Penaeus spp.*); and demersal fish such as summer flounder (*Paralichthys dentatus*).

Intertidal sand and mud flats generally provide more suitable habitat for living marine resources. Conditions such as shallow water depth and exposure to sunlight favor fish nursery functions and increased food production. The intertidal flats of the Cooper

River are recognized as important sites for the growth and maturation of a large and diverse group of fish and invertebrates that are of ecological and economic importance.

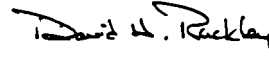
The regularly flooded smooth cordgrass (*Spartina alterniflora*) marsh is a highly productive resource. Its use as forage, cover, and reproductive sites for a variety of living marine resources is also well established. The tidal marsh also has considerable value with regard to estuarine food production and water quality enhancement as provided through erosion abatement, sediment retention, and assimilation of excess nutrients and pollutants.

Based on the ecological and economic value of the aquatic areas that will be affected by the proposed action, impact avoidance, minimization, and mitigation are needed to preclude significant degradation of living marine resources. Needed measures, which are hereby provided in accordance with provisions specified the Fish and Wildlife Coordination Act, include:

1. Restriction of all work involving excavation and filling of aquatic habitats to periods of low biological activity. This would limit such work to December 1 through March 15 of any year;
2. Assessment of the location and size of shellfish beds (if any) in the vicinity of all proposed excavation and fill activities;
3. Avoidance, to the extent practicable, of the loss and degradation of productive shellfish (hard clam) beds, intertidal habitats, and emergent wetlands; and
4. Development of remedial measures needed to offset unavoidable wetland and aquatic resource impacts.

In the absence of these measures we conclude that a significant and unacceptable loss of high quality public trust resources will occur and these elements of the overall Charleston Harbor Deepening Project should not be implemented. The NMFS is willing to cooperate with the Charleston District in the design of project features needed to ensure that project purposes are met and South Carolina's aquatic resources are sufficiently protected. Mr. David Rackley of my staff is available to assist you in this regard. He may be reached at P.O. Box 12607, Charleston, South Carolina 29412, or at (803) 762-8574.

Sincerely,



for Andreas Mager, Jr.  
Assistant Regional Director  
Habitat Conservation Division



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
Southeast Regional Office  
9721 Executive Center Drive North  
St. Petersburg, Florida 33702-2432

December 29, 1994

Lt. Colonel George H. Hazel  
District Engineer, Charleston District  
Department of the Army, Corps of Engineers  
P.O. Box 919  
Charleston, South Carolina 29402-0919

Dear Colonel Hazel:

The National Marine Fisheries Service (NMFS) has reviewed Public Notice 94-1R-498 which advertises new work by the Charleston District, Corps of Engineers, in association with the Charleston Harbor Deepening and Widening Project in Charleston and vicinity, South Carolina.

Comments provided in the U.S. Fish and Wildlife Service's December 20, 1994, response to the Public Notice and in their detailed Fish and Wildlife Coordination Act report were prepared in close coordination with the NMFS. A copy of their December 20, 1994, report is enclosed. We fully concur with the enclosed comments and recommendations and we request that they also be considered as the views and recommendations of the NMFS.

We appreciate the opportunity to provide these comments. Related questions should be directed to the attention of David Rackley at (803) 762-8574.

Sincerely,

*David A. Rackley*

for Andreas Mager, Jr.  
Assistant Regional Director  
Habitat Conservation Division



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
Southeast Regional Office  
9721 Executive Center Drive North  
St. Petersburg, Florida 33702-2432

December 20, 1994

Mr. Roger Banks  
Supervisor  
Charleston Field Office  
U.S. Fish and Wildlife Service  
P.O. Box 12559  
Charleston, South Carolina 29412

Dear Mr. Banks:

The National Marine Fisheries Service has reviewed the Draft Fish and Wildlife Coordination Act Report on the Charleston Harbor Deepening Study. The report describes fish and wildlife resources in the study area, identifies potential effects on those resources, and provides recommendations for reducing possible impacts.

We concur with the findings made in your agency's report and we endorse implementation of the recommendations provided. By copy of this correspondence we hereby notify the Charleston District of their need to coordinate with our Protected Species Branch personnel concerning possible impacts to shortnose sturgeon and sea turtles. Related correspondence should be addressed to Mr. Charles Oravetz at the letterhead address.

We appreciate the opportunity to review the subject document and we request that our comments be compiled into your final report to the Charleston District. Related questions should be directed to the attention of David Rackley at (803) 762-8574.

Sincerely,

*David B. Rackley*

for Andreas Nager, Jr.  
Assistant Regional Director  
Habitat Conservation Division

January 31, 1996

**Planning Branch**

Mr. Charles A. Oravetz  
Chief, Protected Species Management Branch  
National Marine Fisheries Service  
9450 Koger Boulevard  
St. Petersburg, Florida 33702

Dear Mr. Oravetz:

The purpose of this letter is to advise you of modifications being planned for the Charleston Harbor deepening project. The modifications include refurbishment of two existing contraction dikes and construction of a new contraction dike and turning basin. The refurbishment of existing dikes and construction of the new contraction dike are necessary to reducing shoaling in the Daniel Island reach by 50% (See figures 1 and 2).

The existing contraction dikes proposed for refurbishment lie on the west side of the Cooper River, downstream of Shipyard River and upstream of the U.S. Navy degaussing pier. The proposed new contraction dike will be located approximately 150 feet upstream of the U.S. Navy degaussing pier, between the two existing contraction dikes. Marl from the deepening project will be used to provide a foundation base for the proposed dike. Approximately 180,000 cubic yards of marl will be placed as a base with a 12-inch foundation blanket equaling 4000 cubic yards of 6-inch to 12-inch stone. Sheet piling will be sunk into the base marl and foundation stone. The dike will be approximately 1000 feet in length, 300 feet of which is vegetated wetlands on the shoreward end. After excavation and construction of the dike is completed, the effected marsh will be restored on each side of the dike to its original elevation so that marsh grasses will reestablish. The extreme shoreward end of the dike, where it ties into upland will require riprap to prevent scouring. Approximately 800 sq. ft. of emergent wetland will be covered over by this riprap tie-back. Repairs to the two existing dikes will take place within their existing footprint. In addition to the contraction dikes, a turning basin located north of Shipyard River and south of the existing contraction dike (see figure 2) is proposed for construction. The turning basin will be deepened to the same depth as Charleston Harbor which is 49 feet including maintenance and overdepth. Material from the turning basin (3 million cubic yards) will be placed in a diked disposal area. The total area of benthic impact will be approximately 80 acres.

A list of endangered and threatened species which could be impacted by the Charleston Harbor deepening project was received from your office on January 23, 1995. It is assumed that this list has not changed. On January 30, 1995, you concurred with the District's Biological Assessment that none of the listed species would be effected by the deepening project if "standard manatee conditions for use during construction of a project" would be implemented. We believe that the modifications described above also would not affect any of the listed species and further believe that reinitiating consultation under the Endangered Species Act for the modifications is unnecessary, provided all conditions of the original concurrence are met.

We request your concurrence with this letter. Should you have any additional questions regarding the project, please contact Mr. Jim Woody of my staff at (803) 727-4759.

Respectfully,

Richard M. Jackson, P.E.  
Chief, Planning Branch

Enclosures

WOODY/4759/KH

K.HARRIS/EN-P

PREACHER/EN-PR

JACKSON/EN-P





UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office  
9721 Executive Center Drive N.  
St. Petersburg, FL 33702

FEB 7 1996

F/SEO13:JEB

Mr. Richard M. Jackson  
Chief, Planning Branch  
Charleston District  
U.S. Army Corps of Engineers  
P.O. Box 919  
Charleston, SC 29402-0919

Dear Mr. Jackson:

This responds to your letter dated January 31, 1996, regarding a modification to the deepening project for the Charleston Harbor channel and the Shipyard River entrance channel. The original project was determined to not adversely affect threatened or endangered species, if carried out in accordance with the generic opinion with the Corps of Engineers on dredging in the Southeast United States. The modifications to the project include refurbishment of two existing contraction dikes and construction of a new contraction dike and turning basin. A biological assessment was submitted pursuant to Section 7 of the Endangered Species Act of 1973 (ESA).

We have reviewed the modifications to this project and concur with your determination that populations of threatened or endangered species under our purview would not be adversely affected by the proposed action or the modifications provided that all dredging is carried out in accordance with the August 25, 1995 generic biological opinion on dredging in the Southeast U.S. along the Atlantic coast.

This concludes consultation responsibilities under Section 7 of the ESA. However, consultation should be reinitiated if new information reveals impacts of the identified activity that may affect listed species or their critical habitat, a new species is listed, the identified activity is subsequently modified, or critical habitat is determined that may be affected by the proposed activity.

If you have any questions please contact Jeffrey Brown, Fishery Biologist, at (813) 570-5312.

Sincerely,

  
Andrew J. Krumerer  
Regional Director



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
Southeast Regional Office  
9721 Executive Center Drive N.  
St. Petersburg, FL 33702

March 6, 1995

F/SE013:JEB

Thomas W. Waters  
Chief  
Engineering and Planning Division  
U.S. Army Corps of Engineers  
P.O. Box 919  
Charleston, SC 29402-0919

Dear Mr. Waters:

This responds to your letter dated January 25, 1995, regarding deepening the Charleston Harbor channel and Shipyard River entrance channel, from 40 and 38 feet respectively, to 42 feet below mean low water with 2 feet of allowable depth and 2 feet of advance maintenance. A biological assessment was submitted pursuant to Section 7 of the Endangered Species Act of 1973 (ESA) in 1991 prior to the issuance of a generic biological opinion on channel dredging along the Atlantic coast of the Southeast United States.

We have reviewed this project and concur with your determination that populations of threatened or endangered species under our purview would not be adversely affected by the proposed action provided that all dredging is carried out in accordance with the November 1991 biological opinion.

This concludes consultation responsibilities under Section 7 of the ESA. However, consultation should be reinitiated if new information reveals impacts of the identified activity that may affect listed species or their critical habitat, a new species is listed, the identified activity is subsequently modified, or critical habitat is determined that may be affected by the proposed activity.

If you have any questions please contact Jeffrey Brown, Fishery Biologist, at (813) 570-5312.

Sincerely,

*C. J. Kemmerer* for:

Andrew J. Kemmerer  
Regional Director

**Endangered and Threatened Species and Critical Habitats Under  
MOTS Jurisdiction**

**South Carolina**

<u>Listed Species</u>	<u>Scientific Name</u>	<u>Status</u>	<u>Date Listed</u>
finback whale	<u>Balaenoptera physalus</u>	E	12/02/70
humpback whale	<u>Megaptera novaeangliae</u>	E	12/02/70
right whale	<u>Eubalaena glacialis</u>	E	12/02/70
sei whale	<u>Balaenoptera borealis</u>	E	12/02/70
sperm whale	<u>Physeter catodon</u>	E	12/02/70
green sea turtle	<u>Chelonia mydas</u>	Th	07/28/78
hawksbill sea turtle	<u>Eretmochelys imbricata</u>	E	06/02/70
Kemp's (Atlantic) ridley sea turtle	<u>Lepidochelys kempi</u>	E	12/02/70
leatherback sea turtle	<u>Dermochelys coriacea</u>	E	06/02/70
loggerhead sea turtle	<u>Caretta caretta</u>	Th	07/27/78
shortnose sturgeon	<u>Acipenser brevirostrum</u>	E	03/11/67

SP' : PROPOSED FOR LISTING  
}

**LISTED CRITICAL HABITAT**  
None

**PROPOSED CRITICAL HABITAT**  
None



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

343 COURTLAND STREET, N.E.  
ATLANTA, GEORGIA 30365

NOV 14 1995

Mr. Richard M. Jackson, P.E.  
Chief, Planning Branch  
Charleston District, Corps of Engineers  
PO Box 919  
Charleston, South Carolina 29402-0919

Dear Mr. Jackson:

This letter is in response to your request of October 20, 1995 to Mr. Gary Collins concerning a 103 Evaluation of sediments from the Charleston Harbor Deepening Project. We are giving concurrence for the ocean disposal of dredged material from those portions of the project associated with the following test stations: CH-4, CH-5, CH-6, CH-7, CH-9, CH-11, CH-12 and CH-13.

We appreciate the efforts in coordination throughout this evaluation process. Should you have any questions concerning this letter or wish to discuss any of the data, please contact Mr. Gary Collins at 706/546-2294 or Mr. Doug Johnson at 404/347-1740 ext. 4286.

Sincerely,

Wesley B. Crum  
Chief, Coastal Programs Section

OPTIONAL FORM 98 (7-90)		# of pages 1	
FAX TRANSMITTAL			
To: Robin Socha		From: Doug Johnson	
Dist: USCOE - Charleston		Phone: 404-347-1790 X 4286	
Fax: 803-727-4260		Fax: 404-347-1797	
NOM 7540-01-517-7388		5089-101 GENERAL SERVICES ADMINISTRATION	

October 20, 1995

Planning Branch

Mr. Gary Collins  
United States Environmental  
Protection Agency  
Coastal Programs  
345 Courtland Street, N.E.  
Atlanta, Georgia 30365

Dear Mr. Collins:

This letter is in reference to the sediment testing results for the Charleston Harbor Deepening Project. Initial results were submitted to your office in late April 1995. Following your review of the data, bioaccumulation testing for PAH's at two sites, CH-3, located in Shipyard River and CH-4, located adjacent to the proposed Terminal X was required prior to a final 103 Evaluation being conducted by your agency. The bioaccumulation data has been received by this office and is enclosed as requested.

Our review of the bioaccumulation data indicates that the material from site CH-3 is not suitable for ocean disposal and should be disposed of at an upland location.

By copy of this letter, the Charleston District is requesting that your office complete the 103 Evaluation of all the testing results, and provide concurrence that all other sites are suitable for ocean disposal. Please provide a response to the Charleston District by November 15, 1995.

We appreciate your review and assistance. If you have questions, please call Robin Collier-Socha at 803/727-4696.

Respectfully,

RICHARD M. JACKSON, P.E.  
Chief, Planning Branch

HARRIS/EN-P

C-SOCHA/EN-PR/46  
PREACHER/EN-PR

JACKSON /EN-P

## Exhibits

### Prior Studies and Reports

The River and Harbor Act of August 30, 1852 initially authorized \$50,000 for permanent improvements to Charleston Harbor. However, passage of the River and Harbor Act of June 18, 1878 authorized the initial deepening of a navigational channel through the ocean bar to a depth of 21 feet mean low water and construction of two jetties for stabilization of the new channel. Since the passage of these two Acts, numerous studies and reports pertaining to Charleston Harbor have been completed. Information regarding reports written prior to 1974 on Charleston Harbor and Shipyard River are listed at the end of this exhibit.

The October 1974 Interim Feasibility Report recommended that Charleston Harbor be modified to provide for construction and maintenance of a 40-foot and 38-foot Federal navigation project in Charleston Harbor (Cooper River) and Shipyard River, respectively, conditional to implementation of the Cooper River Rediversion Project. The report further stated that if the Cooper River Rediversion Project was delayed, the recommended improved channel depths of 40 and 38 feet for Charleston Harbor and Shipyard River should be reduced to 38 and 35 feet, respectively, during the interim period until rediversion was implemented. This interim feasibility report was printed on April 2, 1976 as part of House Document 94-436, 94th Congress, 2nd Session.

A Phase I AE&D Study of Charleston Harbor, completed in April 1980, was authorized by the 94th Congress in Section 101 of the Water Resource Act of 1976. The purpose of this study was to determine if the recommendations presented in the 1974 Interim Review of Reports on Charleston Harbor were still justified under the Water Resources Council's Principles and Standards. In addition to the channel deepening recommended in the 1974 report, this report recommended realignment of the channel centerline to provide 125 feet between existing docks, piers, etc. and the edge of the channel; easing of the bend at the northern approach to the Cooper River Bridge; widening of Filbin Creek and North Charleston Reaches and Shipyard River Connecting Channel; enlargement of the turning basins at Columbus Street Terminal, North Charleston Terminal, Shipyard River; and enlargement of the anchorage basin.

The final report on Charleston Harbor (Wando River Extension) was completed in January 1984 in compliance to seven congressional resolutions. This report recommended Federal maintenance and deepening of the Wando River deep draft navigational channel which was dredged in the summer of 1981 by the South Carolina State Ports Authority to connect their newly constructed terminal facilities adjacent to Hobcaw Creek with the existing Charleston Harbor project. This report was later published as House Document Number 100-27, 100th Congress, 1st Session dated February 2, 1987.

The Charleston Harbor General Design Memorandum (GDM) was completed in July 1987 in response to passage of the Water Resources Development Act of 1986 (PL 99-662) which authorized deepening of Charleston Harbor generally in accordance with the Phase I AE&D dated April 1980.

Three supplements to the Charleston Harbor GDM were prepared in January 1988, February 1989 and September 1989 recommending enlargement of North Charleston Turning Basin, Columbus Street Turning Basin, and realignment of Lower Town Creek Channel, respectively. Supplements 1 and 2 recommended enlarging the turning basins from the authorized 1200 feet to 1400 feet in order to accommodate larger vessels currently porting at Charleston. Supplement 3 recommended removal of the ends of two piers and realigning Lower Town Creek Channel so that it would parallel the South Carolina State Ports Authority dock and eliminate a hazard to the turning of vessels in the Columbus Street Turning Basin.

The Wando River Extension GDM, dated June 1988, recommended construction and maintenance of a 40-foot deep by 400-foot wide channel from the Cooper River to a 1400-foot by 1400-foot turning basin in the Wando River opposite the South Carolina State Ports Authority's (SCSPA) Wando Terminal at Hobcaw Creek.

A reconnaissance report was prepared in July 1990 under authority of Section 107 of the 1960 River and Harbors Act, as amended, to determine whether there was Federal interest and justification in deepening Shipyard River from 38 feet to 40 feet. The report found that deepening the lower portion of Shipyard River to 40 feet was justified and recommended further detailed studies. This project was terminated during the feasibility study on 1 April 1991 as the project sponsor was unable to obtain the needed financial support from the project users.

Supplement 1 to the Wando River Extension GDM completed in May 1991. The GDM supplement recommended extending the channel 1500 feet so that the additional wharf under construction by SCSPA could be accessible to shipping interests.

The SCSPA has been conducting studies to determine the location of a new containership terminal to accommodate future increases in containerized cargo. In November 1990, SCSPA contracted with Marine Safety International and the Computer Aided Operations Research Facility (CAORF) at the National Maritime Research Center to conduct ship simulation studies on three sites. These three sites were: Site 1, east side of the Cooper River adjacent to Filbin Creek Reach; Site 2, east side of the Cooper River adjacent to Daniel Island Reach; and Site 2A, west side of the Wando River across from the existing Wando Terminal. Both a C-10 and Econ class containership were used in the study due to their size and maneuverability. Results of this study, completed in June 1991, show that the current channel widths to the North Charleston Terminal are insufficient for two-way traffic for larger vessels and that Site 2 was preferable over Site 1 based on ease of

navigability and maintenance requirements. Since Site 2A was more straight-forward than the other two sites, access was not tested.

In 1993 the Daniel Island Alternatives Study was completed. This study was conducted to identify alternate dredged material disposal sites when the Daniel Island Disposal Site became unavailable. Dredged material from Mile 5 to Mile 10 of the federal navigation channel is placed in the 676 acre Daniel Island Disposal Site located on the southern tip of Daniel Island. The analysis considered environmental, costs, and regional social factors of all options. Results of this analysis determined that the least cost plan for disposal of dredged material from Mile 5 to Mile 10 of the navigation channel is the continued use of the Daniel Island Disposal Area in conjunction with the Ocean Dredged Material Disposal Site (ODMDS) and the Drum Island Disposal Site. This conclusion is not favorable to the City of Charleston or the Guggenheim Foundation who have extensive commercial development plans for a large portion of the area. The State Ports Authority owns the western side of the disposal site where the proposed new container terminal is to be located. The loss of the Daniel Island Disposal Site will increase the cost of maintenance dredging by as much \$2,000,000 annually.

#### Reports on Charleston Harbor Written Prior to 1974

<u>Date</u>	<u>Recommendation</u>	<u>Reference</u>
16 Dec 1958	Maintenance and extension of Shem Creek	HD 86-36
10 Jul 1954	Deepen Drum Island Channel from 30 to 35 ft.	SD 83-136
25 Mar 1941	Deepen Anchorage Basin to 30 ft	HD 77-166
19 Apr 1939	Deepen channel to 35 ft from sea to head of project via Cooper River and Town Creek also a channel in Shem Creek to Mt. Pleasant 110 ft wide and 10 ft deep including turning basin at upper end.	HD 76-259
19 Nov 1938	Navigational channel to Columbia not recommended	Annual Report 1937 p 541
8 Feb 1926	Entrance channel 32 ft deep & 1000 ft wide to inner end of jetties, 30 ft deep & 600 ft wide to Navy yard & improve Town Creek to a depth of 35 ft & width of 500 ft & that from the Navy yard to the upstream limit of the terminal be improved to a depth of 30 ft & width of 400 ft with a turning basin 700 ft wide opposite port terminal.	HD 69-249
2 Dec 1924	Modify existing project to provide for dredging to a depth of 30 feet an irregular area in Cooper River where a shoal	HD 68-480



had formed about 2 sunken wrecks.

22 May 1914	Dredge a channel to the Naval Reservation 26 ft deep & 300 ft wide.	HD-63-19
25 Oct 1911	Dredging to secure a depth of 30 ft provided local authorities show that they would provide adequate terminal facilities.	HD 62-288
27 Jan 1904	Dredge to secure a channel 28 ft deep, 500 ft wide between the jetties & 1000 ft seaward to the 28-ft depth.	HD-58-499
15 Dec 1898	Dredging to secure a channel 26 ft deep at low water & 600 ft wide by constructing a large sea-going dredge & operating it in connection with the dredge then owned by the project.	HD 55-83
-	Recommended modification of the height & length of the jetties but no change in their position or distance apart.	Annual Report 1915 p 554
-	Provisions for establishing & maintaining by means of two jetties & auxiliary dredging a channel of not less than 21 ft deep across the bar.	Annual Report 1878 p 554

#### Reports on Shipyard River Written Prior to 1974

Aug 1959	Recommended widening the access reach from 200 ft to 300 ft in the interest of safety.	District Rpt
15 Feb 1950	Recommended no improvements at that time	District Rpt
11 Apr 1942	Extension of the existing 30-ft channel to vicinity of Pittsburgh Metallurgical Co. plant with a turning basin at the upper end.	HD 79-93
16 Jun 1931	Enlargement of the channel to a depth of 30 ft & a width of 200 ft up to the Gulf Oil Terminal with a turning basin 30 ft deep at the latter point.	R&H Comm Doc 38 75 Cong
8 May 1934	28-ft channel from Cooper River to the Gulf Oil Terminal & deepening of the channel above that point to 20 ft from the depth of 12 ft previously authorized without local cooperation.	R&H Comm Doc 43 73 Cong
6 Dec 1929	Channel depths of 10 & 20 ft.	R&H Comm Doc 13 71 Cong

